United States
Department of
Agriculture

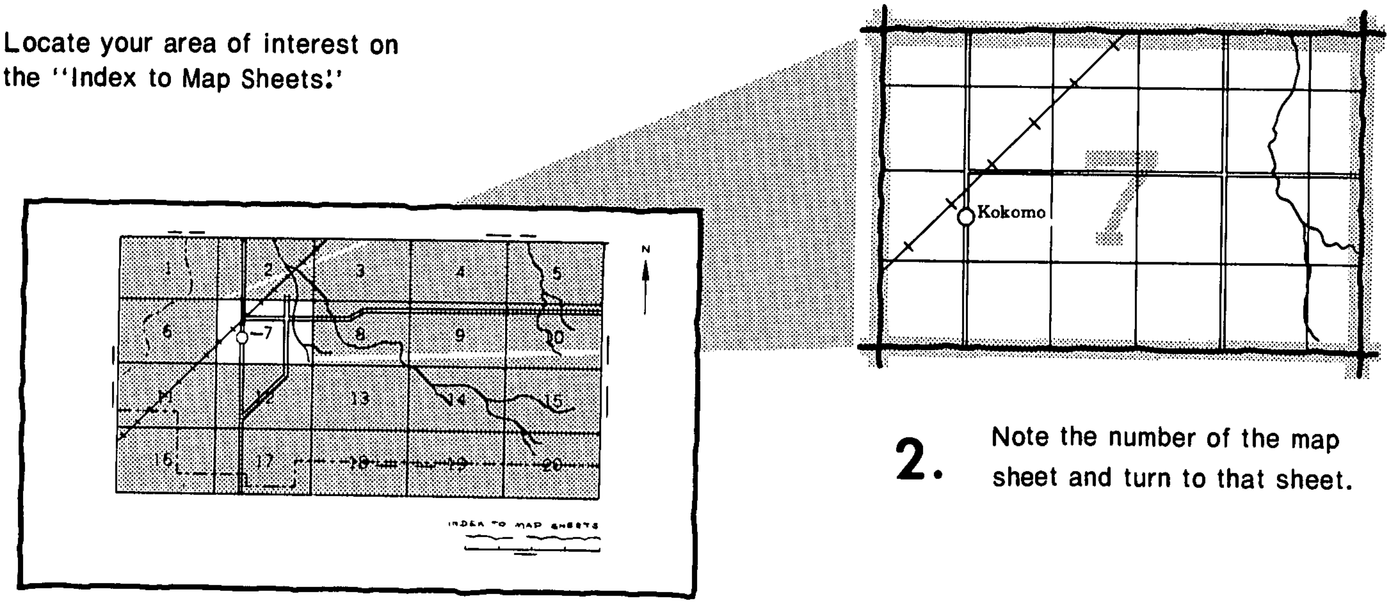
Soil
Conservation
Service

In cooperation with
Illinois Agricultural
Experiment Station

Soil Survey of Hamilton County, Illinois

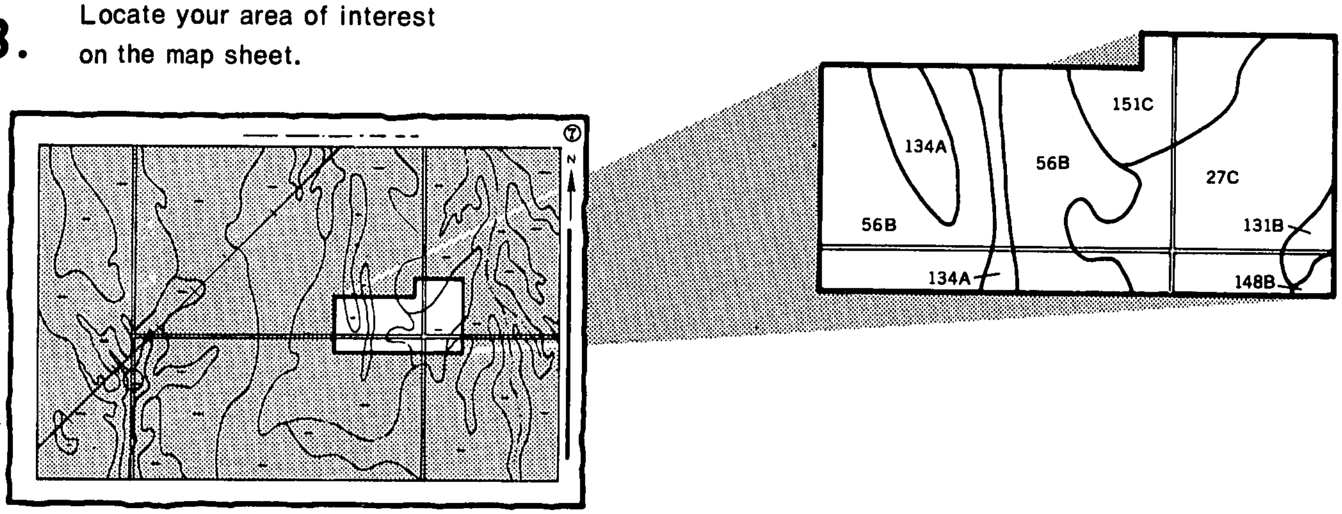
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets."

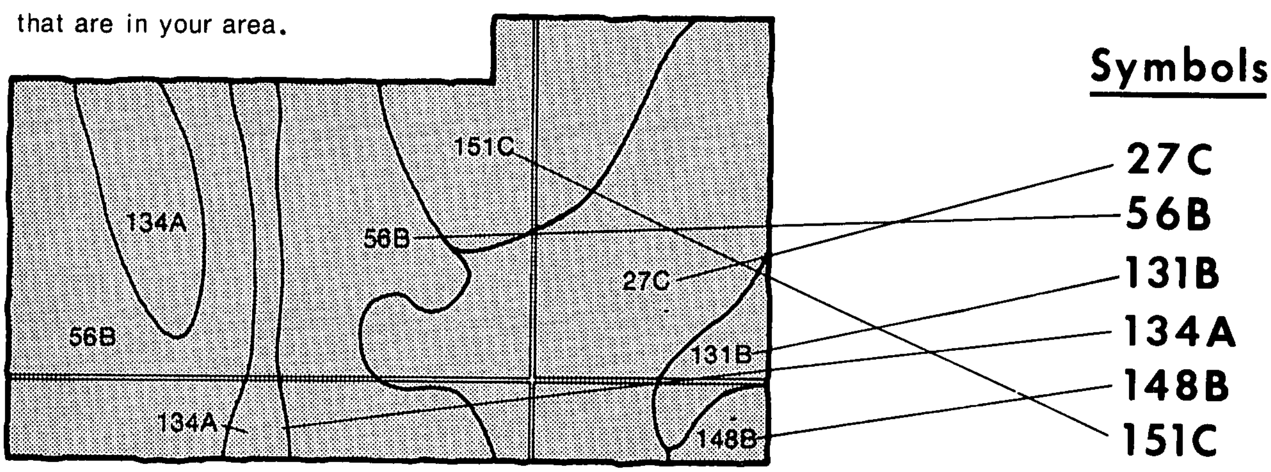


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

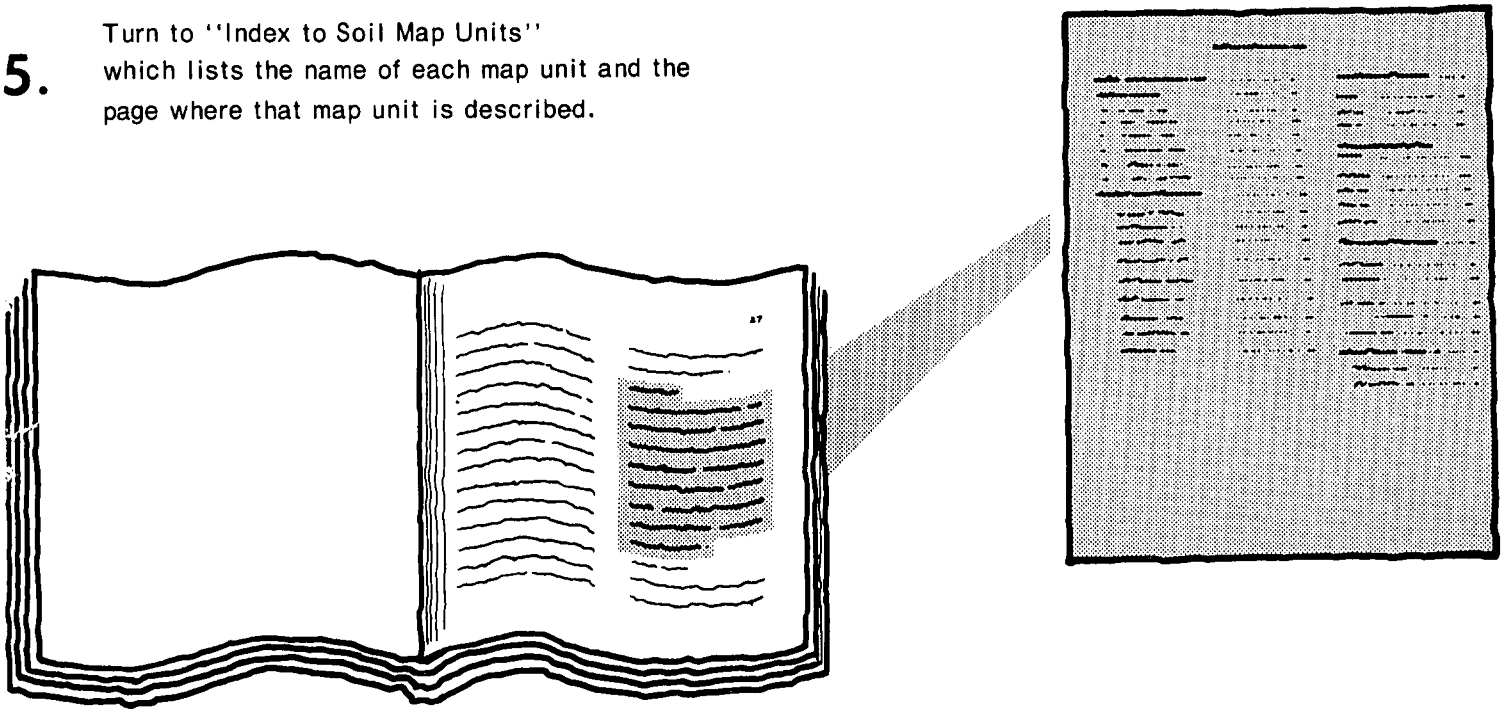


4. List the map unit symbols that are in your area.

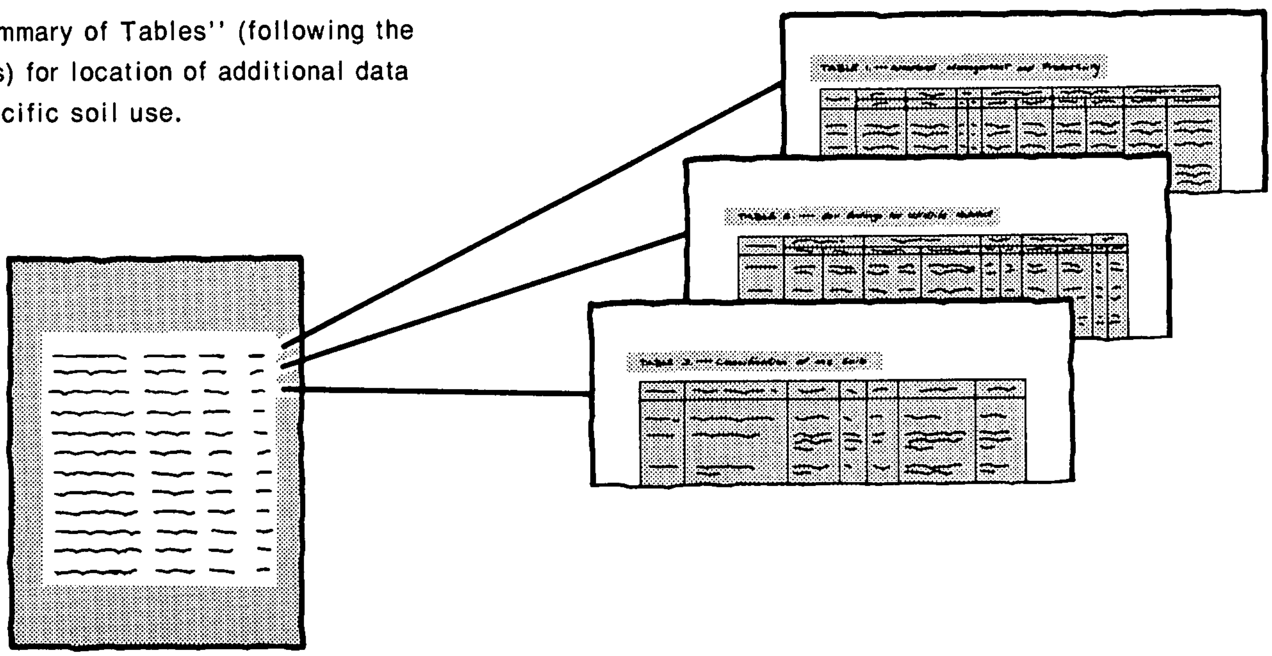


THIS SOIL SURVEY

5. Turn to ''Index to Soil Map Units'' which lists the name of each map unit and the page where that map unit is described.



6. See ''Summary of Tables'' (following the Contents) for location of additional data on a specific soil use.



7. Consult ''Contents'' for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1981. Soil names and descriptions were approved in 1982. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service and the Illinois Agricultural Experiment Station. It is part of the technical assistance furnished to the Hamilton County Soil and Water Conservation District. The cost was shared by the Hamilton County Board of Supervisors.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale. This soil survey is Illinois Agricultural Experiment Station Soils Report No. 119.

Cover: An area of a strongly sloping, severely eroded Zanesville soil used for hay.

Contents

Soil Series

Issued June 1986

Index to Map Units

Summary of Tables

Foreword

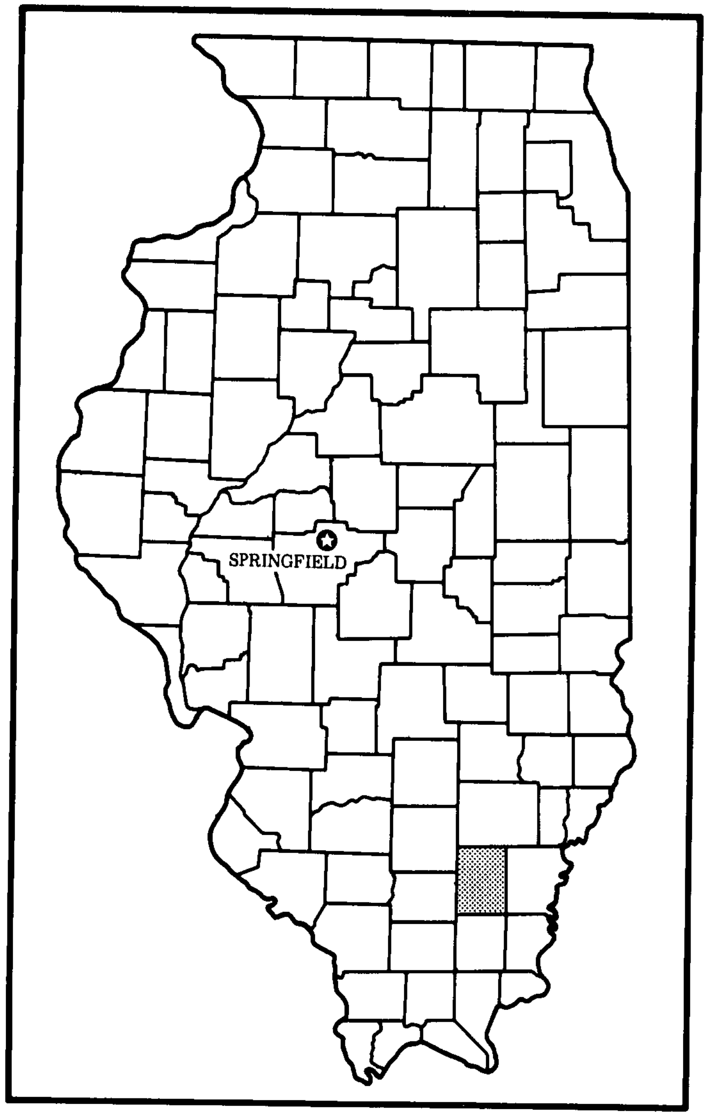
This soil survey contains information that can be used in land-planning programs in Hamilton County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

John J. Eckes
State Conservationist
Soil Conservation Service



Location of Hamilton County in Illinois.

Soil Survey of Hamilton County, Illinois

By Bruce Currie, Soil Conservation Service

Soils surveyed by Bruce Currie and Jack L. Simpson,
Soil Conservation Service, and Dennis Frey, Hamilton County

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Illinois Agricultural Experiment Station

General Nature of the County

HAMILTON COUNTY is in the southeastern part of Illinois. It has a total area of 278,400 acres. In 1980, the population was 9,172. McLeansboro, the county seat and largest town, had a population of 2,789.

Hamilton County is mainly on glacial till plains. Large areas, however, are on glacial lake plains and Pennsylvanian-age bedrock.

Agriculture is the main enterprise in the county. Cash-grain corn, soybeans, and wheat are the main crops. Livestock, mainly cattle and hogs, are provided the feed grain and forage produced in the county. Production of fossil fuels provides many jobs in the county.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Hamilton County is cold in winter and quite hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. The normal annual precipitation is adequate for all of the crops that are adapted to the temperature and the length of the growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at McLeansboro, Illinois, in the period 1951 to 1978. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 34 degrees F, and the average daily minimum temperature is 25 degrees. The lowest temperature on record, which occurred at McLeansboro on January 17, 1977, is -21 degrees. In summer, the average temperature is 76 degrees and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 108 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 41 inches. Of this, 22 inches, or about 50 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 4.78 inches at McLeansboro on July 28, 1961. Thunderstorms occur on about 45 days each year. Tornadoes and severe thunderstorms occur occasionally. These storms are usually local in extent and of short duration and cause damage in a variable pattern.

The average seasonal snowfall is 13 inches. The greatest snow depth at any one time during the period of record was 13 inches. On the average, 10 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 75 percent in summer and 50 percent in

winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 10 miles per hour, in spring.

History and Development

The earliest known inhabitants of the survey area were the Baumer, or Early Woodland Culture. They occupied the area about 3,000 years before settlement by Europeans. In the early 1800's, the settlers encountered a few Indians believed to have been from the Shawnee and Kickapoo Tribes.

When the first permanent settlers arrived in the early 1800's, the area was a primitive natural wilderness of rolling slopes wooded primarily with oak and hickory, only scattered small areas of prairie, and two large wooded areas of wet bottom land. Wildlife was abundant, and domestic livestock and crops had to be protected from wild predators. In 1821, the Illinois Legislature divided what was then White County and named the western part Hamilton County, after Alexander Hamilton (*5*).

A major land use change occurred in the 1800's as agricultural use of the soils grew extensively and the woodland was cleared for farming. By 1878, about 25,200 acres was used for wheat, 28,700 acres for corn, 5,700 acres for oats, 7,000 acres for pasture, 3,000 acres for tobacco, and 2,400 acres for apple orchards. Many small industries were established to process the crops and to provide supplies and equipment for farming. These industries included grist and flour mills, fruit-drying plants, canneries, and cigar factories (*4*).

Many roads in the county originally were the trails made by the early pioneers. The pioneers used the trails when they marketed their products and bought supplies. The railroads connecting McLeansboro with St. Louis, Evansville, and Shawneetown began operating in 1871. They were used for shipping farm products to market.

The population of Hamilton County continued to grow until about 1900, when it reached a peak of just over 20,000. Most of this population was located on small farms, although many depended on outside sources of income. The coal industry enjoyed a brief expansion about the turn of the century but was discontinued because of more readily available sources in counties to the south and west. For the next 40 years, most of the residents relied on farming for their livelihood. During this time, much of the land was seriously abused by poor farming practices.

The oil industry expanded rapidly in the 1940's. This expansion lasted about 20 years. The revenues from the sale of petroleum gave renewed vigor to the economy, but the drilling also left areas of the land damaged by salt spillage and poor production techniques. By 1960, oil production had decreased considerably and the county again relied on agriculture for most of its income. During the past 20 years, agricultural production has greatly increased because of expanded mechanization, clearing of large acreages of forested bottom land, and more extensive use of fertilizer.

At present, the county is primarily an agricultural community. The farms are larger than they were in the past, and a greater percentage of the people derive their income from nonfarm sources. The current industry centers around the importation of semiprocessed products and the shipping of unprocessed agricultural products to river terminals.

Natural Resources

Coal and oil are important natural resources in Hamilton County. The coal reserves are estimated at nearly 4.5 billion tons. Coal production in 1981 was about 652,000 tons. In the same year, the oil industry produced approximately 543,700 barrels of oil. In recent years, coal production has become an economic factor and oil production has generally declined. Increased prices of oil, however, are bringing about more exploration.

The most abundant natural resource in Hamilton County is the soil. Approximately 170,000 acres is cropland. Unlike coal and oil, the soil is a renewable resource. If erosion is controlled and the fertility level maintained, cropland can remain productive year after year. Careful planning is needed to maintain the potential for agricultural production and to limit the loss of prime farmland to other uses, such as roads, recreational and urban development, and mining.

Relief, Physiography, and Drainage

Elevation in Hamilton County ranges from about 360 to 630 feet above sea level. The highest elevation is on Davis Hill, in Knights Prairie Township. The lowest is in an area in the southeastern part of the county where the North Fork of the Saline River leaves the county.

The soils in the county formed dominantly in three geologically different kinds of parent material. These are material weathered from Pennsylvanian-age bedrock, glacial till, and water-deposited sediment. Pennsylvanian-age formations of sandstone, siltstone, and shale dominate the more rugged areas where glaciers had little or no influence on the landscape. The ridges in these areas have a fairly thick loess cap, which thins out as the side slopes become steeper.

Illinoian glaciation influenced the landscape in Hamilton County, smoothing the hills and resulting in less pronounced relief. Glacial drift covers most of these areas. It is 5 to 30 feet thick. A thin layer of loess overlies the till in most areas.

Large areas of the county are dominated by nearly level soils that formed in water-deposited sediment. These either are alluvial soils formed in silty material deposited by water along streams or are lakebed soils formed in more clayey sediment in slack-water glacial

lakes. Many of these soils are naturally poorly drained, but drainage ditches have been dug to reduce the wetness and the hazard of flooding.

Surface drainage is generally in three directions. Most of the county is in the watershed of the Wabash River. Approximately 135,000 acres is drained towards the south into the Saline River, and 120,000 acres is drained northeasterly into the Skillet Fork River. The remaining 23,000 acres is drained towards the west into the Big Muddy River. The county has no streams of economic importance for fishing or transportation. The many miles of drainage ditches, however, help to prevent flood damage to cropland and reduce wetness.

The natural drainage pattern in the rolling uplands is well expressed. After heavy rains, the runoff results in serious erosion in these uplands and causes siltation and flooding on the flood plains. The water soon drains away, however, leaving the stream channels dry most of the time.

The less rolling uplands are not well drained. They are not sufficiently sloping for surface water to drain away, and permeability is too slow in the subsoil for maximum crop yields. Most of these areas have been drained by open ditches. As a result, the wetness causes little damage to crops.

Most of the nearly level soils on bottom land are naturally poorly drained or somewhat poorly drained. Extensive drainage systems have been installed to remove excess water from these areas. Although some flood damage occurs, these soils are flooded during the growing season less often than once in 2 years.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will

always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

Map Unit Descriptions

This section describes the map units in the survey area at two levels of detail. The general soil map units, called soil associations, are described first and then the detailed map units. Most of the general soil map units represent the soils of major extent in the survey area. The detailed map units represent all of the named soils in the survey area.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Association Descriptions

1. Bluford-Ava Association

Nearly level to strongly sloping, somewhat poorly drained and moderately well drained soils formed in loess and in the underlying silty or loamy material; on uplands

This association consists mainly of soils on undulating to rolling loess-covered till plains drained by narrow drainageways and meandering streams. Slopes range from 0 to 18 percent.

This association makes up about 44 percent of the county. It is about 40 percent Bluford soils, 30 percent Ava soils, and 30 percent minor soils (fig. 1).

Bluford soils are nearly level and gently sloping and are somewhat poorly drained. They are on broad ridges and on some side slopes. Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsurface layer is pale brown, mottled silt loam about 7 inches thick. The subsoil to a depth of more than 60 inches is mottled silty clay loam. The upper part is pale brown and light brownish gray, and the lower part is brown and brittle.

Ava soils are gently sloping to strongly sloping and are moderately well drained. They are on ridgetops and side slopes. Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark yellowish brown and yellowish brown silt loam; the next part is yellowish brown, mottled silty clay; and the lower part is yellowish brown, brittle silty clay loam and brownish yellow, brittle silt loam.

Some of the minor soils in this association are Belknap and Sharon soils on flood plains and the well drained Hickory soils on upland side slopes.

Most of this association is used for cultivated crops. Some sloping areas are used for pasture or hay. The less sloping areas are well suited or moderately well suited to cultivated crops, pasture, and hay. Severely eroded areas are poorly suited to cultivated crops and moderately suited to pasture and hay. The association is well suited to woodland and to habitat for openland and woodland wildlife.

This association generally is poorly suited to dwellings and septic tank absorption fields. The wetness, the shrink-swell potential, the slow or very slow permeability, and the slope are limitations affecting these uses.

2. Grantsburg-Zanesville Association

Gently sloping to strongly sloping, moderately well drained soils formed in loess and the underlying silty or loamy erosional sediments or in loess and the underlying material weathered from sandstone, siltstone, and shale; on uplands

This association consists of soils on linear ridgetops, knolls, and side slopes along narrow drainageways and meandering streams. The ridgetops are normally narrow and convex, and the side slopes are complex. Slopes range from 2 to 18 percent.

This association makes up about 20 percent of the county. It is about 33 percent Grantsburg soils, 27 percent Zanesville soils, and 40 percent minor soils (fig. 2).

Grantsburg soils are gently sloping and sloping and are on ridges, knolls, and the upper side slopes. Typically, the surface layer is brown silt loam about 7 inches

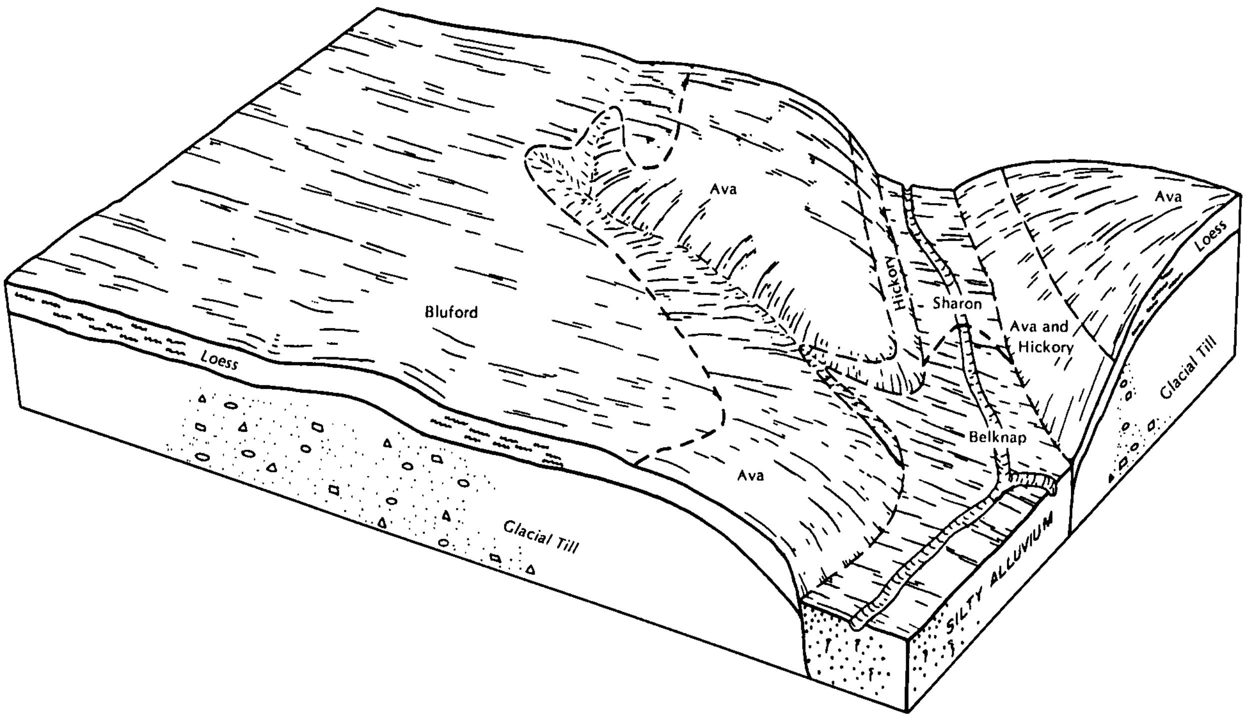


Figure 1.—Pattern of soils and parent material in the Bluford-Ava association.

thick. The subsoil extends to a depth of more than 60 inches. The upper part is strong brown and yellowish brown silt loam, the next part is yellowish brown and strong brown silty clay loam, and the lower part is yellowish brown, mottled, brittle silt loam.

Zanesville soils are sloping and strongly sloping and are on side slopes. Typically, the surface layer is yellowish brown silt loam about 3 inches thick. The subsoil is about 49 inches thick. The upper part is strong brown silty clay loam; the next part is strong brown, brittle silt loam; and the lower part is yellowish brown channery silt loam. Weathered sandstone and shale bedrock is at a depth of about 52 inches.

Some of the minor soils in this association are the well drained Frondorf and Wellston soils on steep side slopes and Sharon soils on narrow flood plains.

This association is used mainly for cultivated crops and pasture on the ridgetops and the less sloping side slopes. Most of the steeper side slopes are used as woodland or are abandoned cropland. The association is well suited to cropland on ridgetops and moderately suited or poorly suited to cropland on the more sloping side slopes and in severely eroded areas. It is moderately suited or poorly suited to woodland and pasture. This association supports more native hardwoods than any other association in the county. Also, the percentage of the acreage that is being planted to pine is higher. The association is well suited to habitat for woodland and openland wildlife. The ridgetops and the less sloping side slopes are well suited to food-producing plants. Established stands of native oak, hickory, and other trees provide both food and shelter for wildlife. Erosion is the main hazard in cultivated and pastured areas. Seedling mortality and windthrow are concerns in managing the woodland.

This association is moderately suited or poorly suited to dwellings without basements and poorly suited to dwellings with basements. Seasonal wetness and slope are the major limitations affecting these uses. In most areas the association is poorly suited to septic tank absorption fields. Seasonal wetness and slow or very slow permeability are the main limitations.

3. Belknap-Bonnie Association

Nearly level, somewhat poorly drained and poorly drained soils formed in silty alluvium; on flood plains

This association consists of silty soils on flood plains throughout the county and on the upper edges of glacial lakebeds. Slopes range from 0 to 2 percent.

This association makes up about 22 percent of the county. It is about 44 percent Belknap soils, 33 percent Bonnie soils, and 23 percent minor soils (fig. 3).

Belknap soils are on the flood plains that dissect the uplands and along the higher parts of the major drainageways on the broad flood plains. They are somewhat

poorly drained. They are occasionally flooded for brief to long periods from March through June. Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The underlying material to a depth of about 60 inches is mottled silt loam. The upper part is grayish brown, and the lower part is light brownish gray.

Bonnie soils are on broad flood plains and in some depressional areas and old slough channels. They are poorly drained. They are frequently flooded for long periods from March through May. Typically, the surface layer is brown silt loam about 8 inches thick. The underlying material to a depth of about 60 inches is mottled silt loam. The upper part is light brownish gray, and the lower part is light gray.

Some of the minor soils in this association are the somewhat poorly drained Banlic soils and the poorly drained Piopolis and Racoon soils. Banlic soils are on the slightly higher areas, especially where coarse silt has been deposited on a delta or a natural levee. They have a brittle layer in the lower part of the subsoil. Piopolis soils are dominantly silty clay loam throughout. They are along the border of wide flood plains and lakebeds. Racoon soils are on terraces or foot slopes bordering the uplands. They are silty clay loam in the control section.

This association is used mainly for cultivated crops, but some small areas are used as woodland. The association is well suited or moderately well suited to cropland and well suited to woodland. It is generally unsuited to dwellings and septic tank absorption fields because of flooding and wetness. It is well suited or moderately well suited to habitat for wetland and openland wildlife. Seasonal wetness, ponding, and flooding adversely affect most uses. The equipment limitation, seedling mortality, and windthrow are concerns in managing the woodland.

4. Zipp Association

Nearly level, poorly drained soils formed in clayey alluvial or lacustrine sediments; on flood plains and in glacial lakebeds

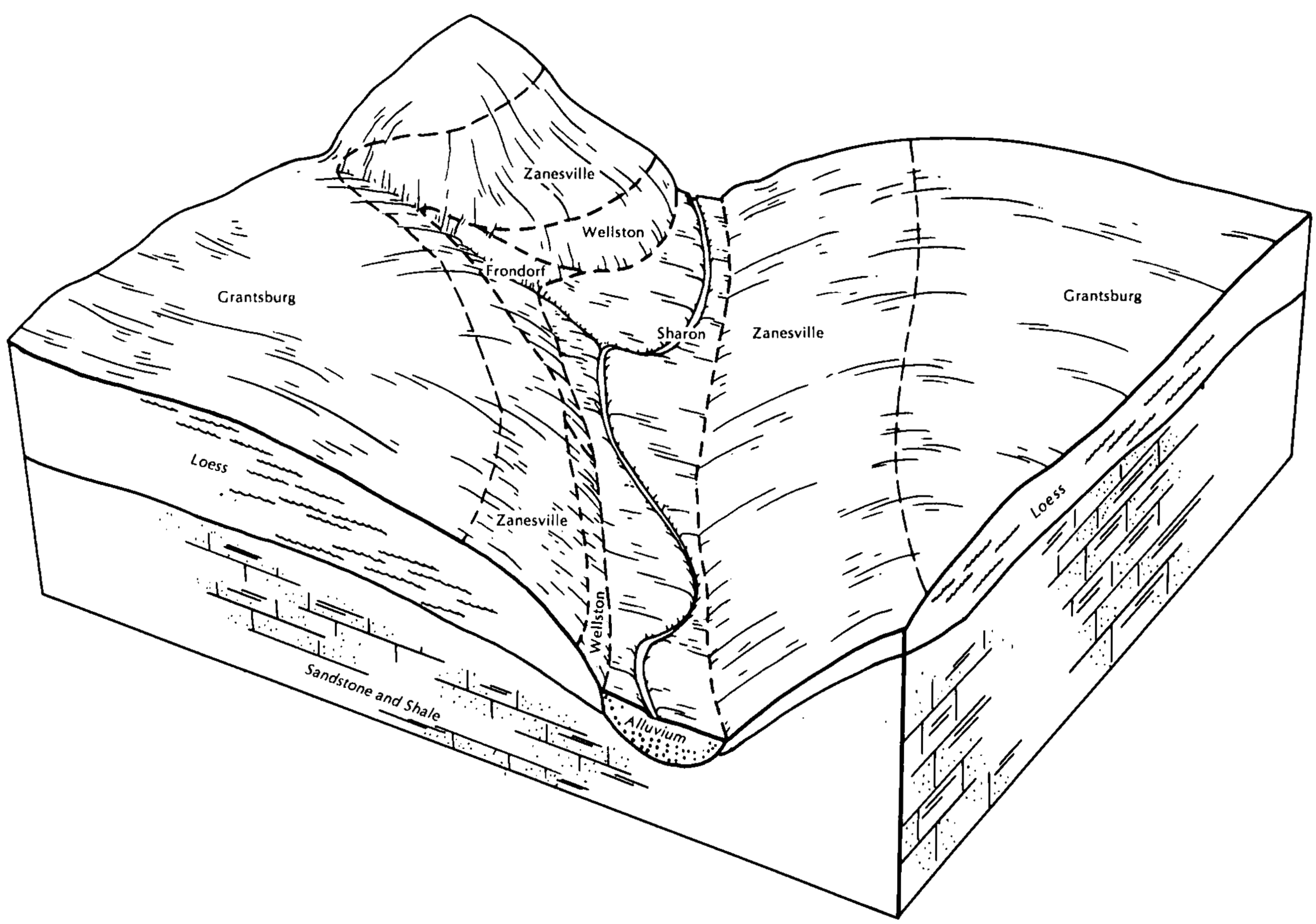


Figure 2.—Pattern of soils and parent material in the Grantsburg-Zanesville association.

This association consists of soils on broad flood plains and in glacial lakebeds. Slopes are less than 2 percent.

This association makes up about 9 percent of the county. It is about 70 percent Zipp soils and 30 percent minor soils (fig. 4).

Zipp soils are occasionally flooded for brief periods from December through May. Typically, the surface layer is very dark grayish brown silty clay about 6 inches thick. The subsoil is gray, mottled silty clay about 38 inches thick. The underlying material to a depth of about 60 inches is gray, mottled silty clay loam.

Some of the minor soils in this association are the poorly drained Petrolia, Piopolis, and Titus soils and the somewhat poorly drained McGary soils. Petrolia and Piopolis soils contain less clay than the Zipp soils. They are in the slightly higher positions on the landscape. Titus soils are on slight rises. They have a surface layer that is darker than that of the Zipp soils. McGary soils are on stream terraces above the lakebeds.

Most areas of this association are used for cultivated crops. A few are used as woodland. The association is moderately suited to cultivated crops and well suited to habitat for woodland and wetland wildlife. Seasonal wetness, ponding, and flooding adversely affect most uses. The equipment limitation, seedling mortality, and windthrow are concerns in managing the woodland. The association is generally unsuited to dwellings and septic tank absorption fields because of seasonal wetness, flooding, ponding, the shrink-swell potential, and slow permeability.

5. Bluford-Hoyleton-Cisne Association

Nearly level and gently sloping, somewhat poorly drained and poorly drained soils formed in loess and in the underlying silty or loamy material; on uplands

This association consists mainly of soils on broad ridges on loess-covered till plains that have some low mounds. Slopes range from 0 to 6 percent.

This association makes up about 5 percent of the county. It is about 40 percent Bluford soils, 30 percent Hoyleton soils, 10 percent Cisne soils, and 20 percent minor soils (fig. 5).

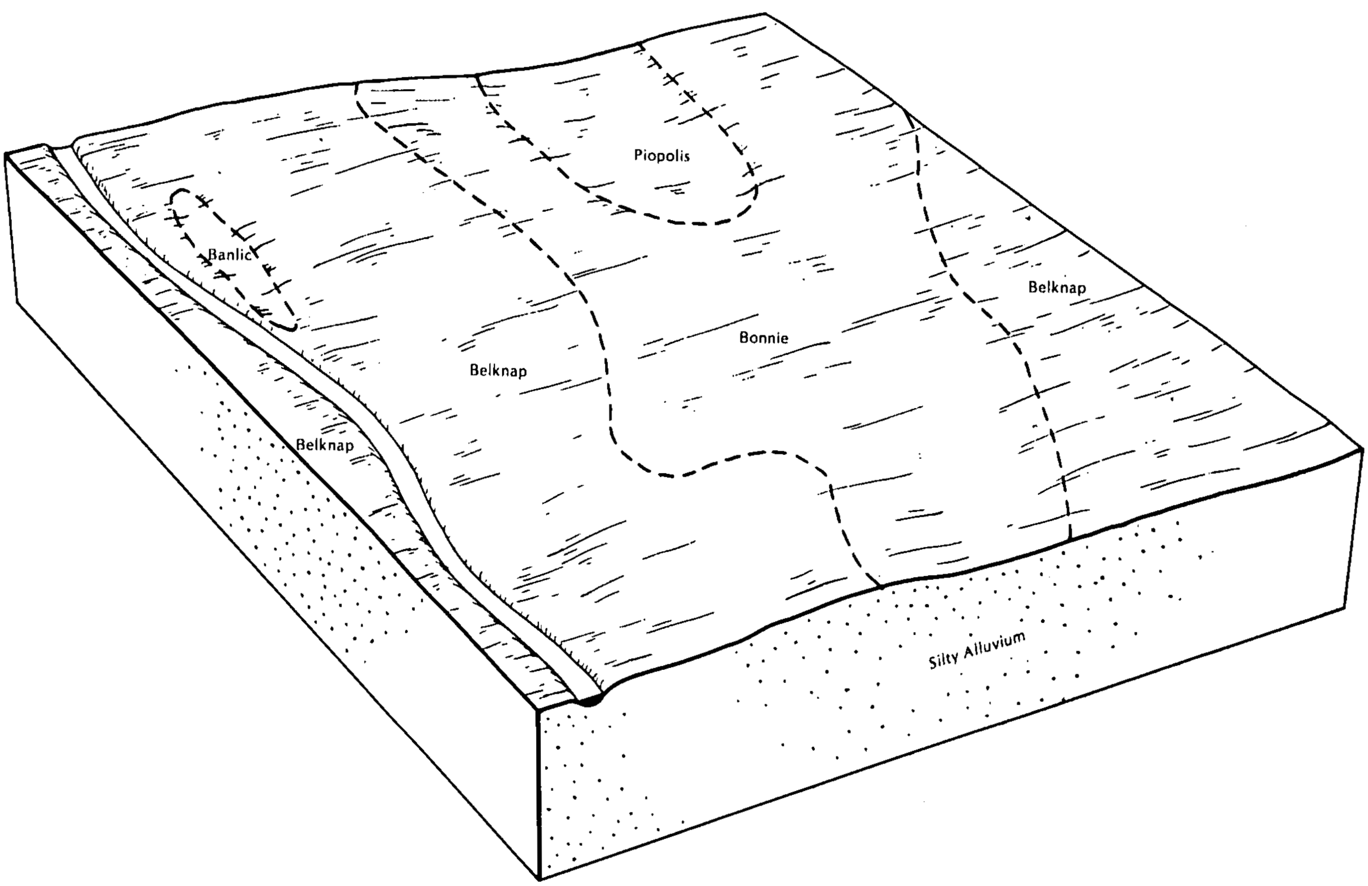


Figure 3.—Pattern of soils and parent material in the Belknap-Bonnie association.

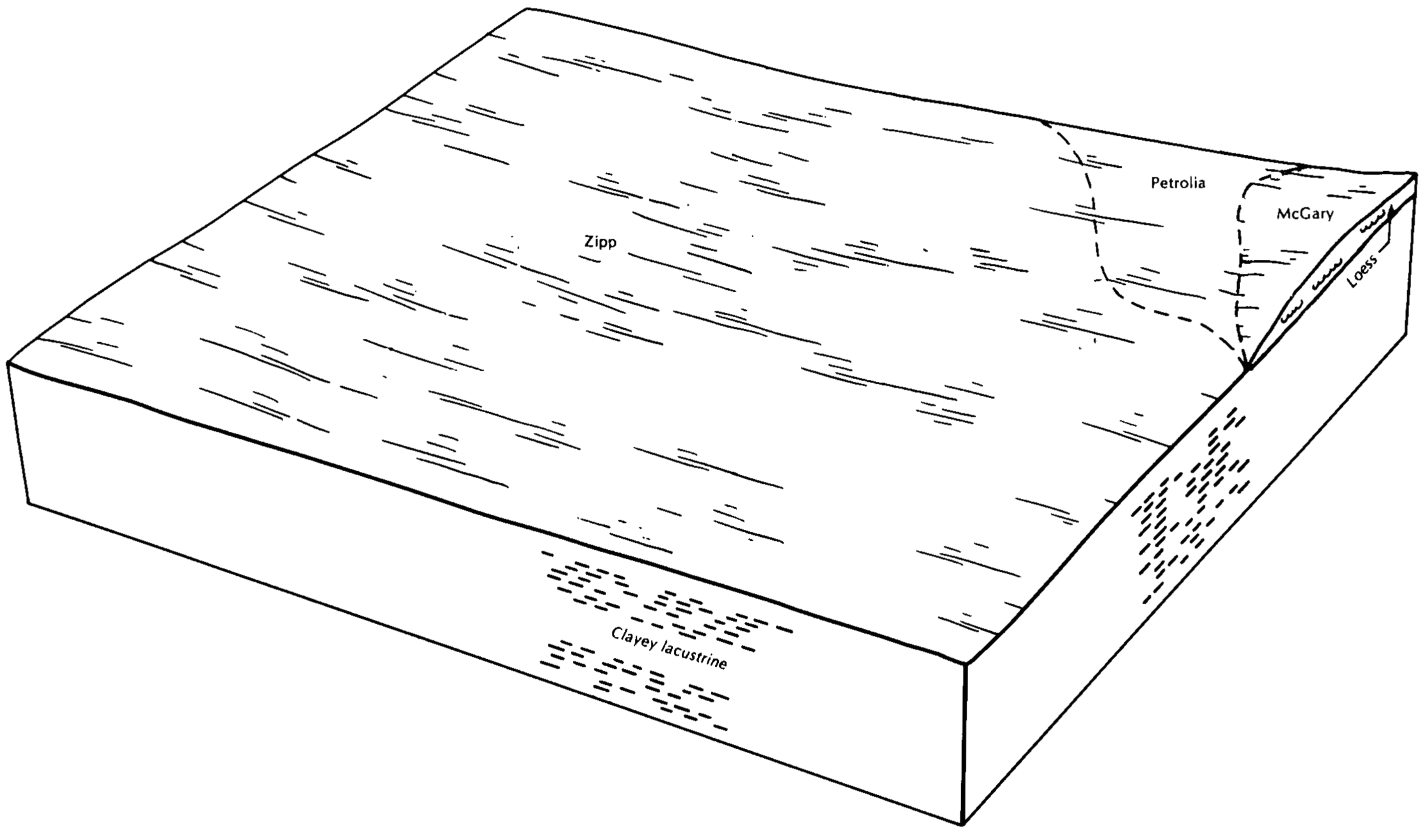


Figure 4.—Pattern of soils and parent material in the Zipp association.

Bluford soils are gently sloping and nearly level and are somewhat poorly drained. They are on low ridges and gentle side slopes. Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsurface layer is pale brown, mottled silt loam about 7 inches thick. The subsoil to a depth of more than 60 inches is mottled silty clay loam. The upper part is pale brown and light brownish gray, and the lower part is brown and brittle.

Hoyleton soils are gently sloping and are somewhat poorly drained. They are on low knolls and short side slopes. Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The subsoil extends to a depth of more than 60 inches. It is mottled. The upper part is yellowish brown silt loam, the next part is pale brown and light brownish gray silty clay loam, and the lower part is brown and light brownish gray silty clay loam in which the content of sand is more than 10 percent.

Cisne soils are nearly level and are poorly drained. They are on broad flats and in slight depressions. Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray and light gray, mottled silt loam about 8 inches thick. The subsoil extends to a depth of more than 60 inches. It is mottled. The upper part is light brownish gray silty clay loam, and the lower part is grayish brown silt loam.

Some of the minor soils in this association are Ava, Belknap, Creal, and Racoon soils. Ava soils are moderately well drained and are generally in the more sloping areas. Belknap soils are on narrow flood plains. Creal and Racoon soils have less clay in the subsoil than the major soils. They are on flats, on foot slopes, or in depressions.

Most areas of this association are used for cultivated crops. The association is well suited to the cultivated crops commonly grown in the county. The seasonal wetness of all the major soils and erosion on the gently sloping soils are management concerns in cultivated areas. The association is well suited or moderately well suited to habitat for openland wildlife.

This association is poorly suited to dwellings and septic tank absorption fields. The seasonal wetness, the shrink-swell potential, and the slow permeability are the major limitations affecting these uses.

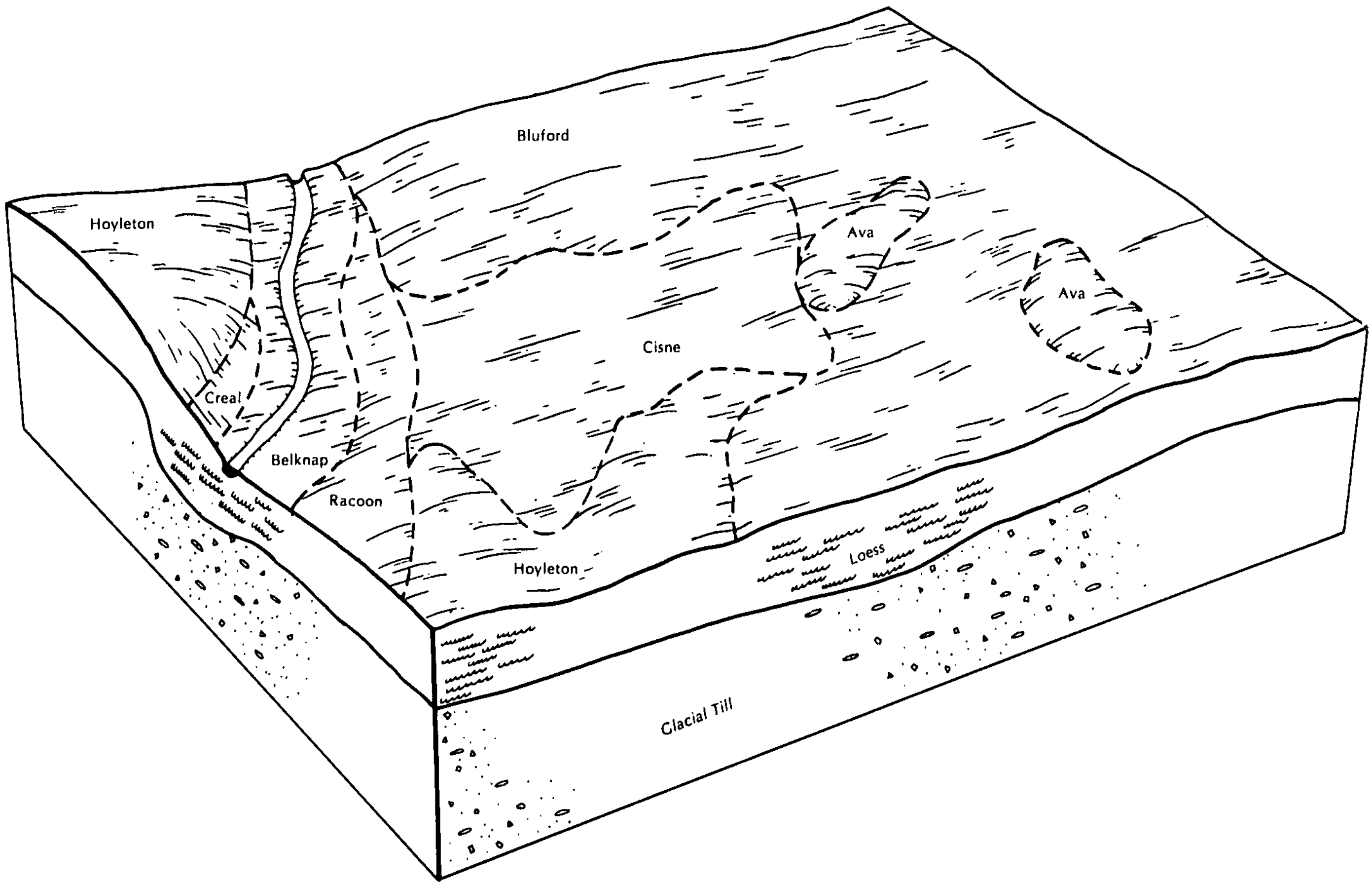


Figure 5.—Pattern of soils and parent material in the Bluford-Hoyleton-Cisne association.

Broad Land Use Considerations

The soils in Hamilton County vary widely in their suitability for major land uses. Most of the land in the county is used for cultivated crops, dominantly corn and soybeans. This cropland is in scattered areas throughout the county, mainly in associations 1, 3, 4, and 5. In cultivated areas of associations 1, 2, and 5, which are on uplands, erosion is the main hazard. Wetness is the major limitation in cultivated areas of associations 3 and 4. The soils in these two associations are frequently flooded, principally in winter and early in spring. The flooding causes slight or moderate crop damage. The soils in associations 3, 4, and 5 have the highest natural fertility and available water capacity. The soils in association 2 generally are unsuited to row crops because of the erosion hazard.

Several thousand acres in Hamilton County are used for pasture or woodland. Much of this acreage is in associations 1, 2, and 3. The highest acreage is in association 2. Recently, large areas of the woodland in association 4 have been cleared and converted to cropland. Only small acreages of the woodland are managed for commercial timber production. Wooded areas where trees are newly planted have good potential for wildlife habitat.

The suitability for recreation uses varies, depending upon the type and intensity of the expected use. Association 2 is the most scenic association, but the slope, wetness, and the erosion hazard limit recreational development. Ponding, flooding, and wetness limit the development of associations 3 and 4 for recreational uses. The soils best suited to recreational uses are probably those in association 1, but slow and very slow permeability, wetness, and erosion are problems. Also, the soils in this association are well suited to other land uses and thus are unlikely to be used as recreation areas.

The suitability for the development of habitat for selected types of wildlife is good throughout the county. Association 2 is well suited to woodland wildlife habitat, associations 1 and 5 are well suited to openland wildlife habitat, and associations 3 and 4 are well suited to wetland wildlife habitat.

Various limitations affect the use of the soils in the county for building site development and onsite waste disposal. The soils in association 1 are limited as sites for sanitary facilities and buildings because of wetness. Slow or very slow permeability also is a limitation on sites for septic tank absorption fields. Low strength and frost action are limitations on sites for local roads and streets.

The soils in association 2 are too steep to be used as construction sites. Wetness is an additional limitation. Also, excavation is difficult in many of these soils because of a limited depth to bedrock. The ridgetops in areas of this association are the best construction sites. Because of slow and very slow permeability, septic systems can fail unless a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed.

The soils in associations 3 and 4 are generally unsuitable as sites for sanitary facilities and buildings because of flooding, ponding, and wetness. The soils in association 5 generally are limited by wetness, slow permeability, a moderate or high shrink-swell potential, and a high potential for frost action. They are suitable as sites for sewage lagoons. Installing tile drains around footings and backfilling with gravel or sand help to overcome some of the limitations on sites for dwellings. The soils are drained most commonly by shallow surface ditches.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Bluford silt loam, 2 to 5 percent slopes, is one of several phases in the Bluford series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Ava-Hickory complex, 10 to 18 percent slopes, severely eroded, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

2—Cisne silt loam. This nearly level, poorly drained soil is on low, broad loess-covered till plains. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray and light gray, mottled silt loam about 9 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is light brownish gray, mottled silty clay loam, and the lower part is grayish brown, mottled silt loam. In some areas the surface layer is lighter in color. In other areas the subsoil contains less clay and more silt.

Included with this soil in mapping are small areas of Bluford soils. These soils are somewhat poorly drained, have brittle layers in the lower part of the subsoil, and are slightly higher on the landscape than the Cisne soil. Also included are some areas of the somewhat poorly drained Hoyleton soils on small, low knolls and small areas of Racoon soils in shallow depressions that are subject to ponding. Included soils make up 5 to 10 percent of the unit.

Water and air move through the Cisne soil at a very slow rate. Surface runoff is slow. A perched seasonal high water table is within a depth of 2 feet from February through June in most years. Available water capacity is moderate. The surface layer typically is slightly acid because of past liming practices but is strongly acid or medium acid if not limed. The subsoil is medium acid to

very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is high in the subsoil.

Most areas are cultivated. This soil is moderately suited to cultivated crops. It is poorly suited to dwellings and septic tank absorption fields.

This soil is sufficiently drained for soybeans, corn, and small grain. Measures that maintain or improve the drainage system are needed. A combination of surface ditches and land leveling reduce the wetness. Tilling when the soil is wet causes surface compaction and decreases the rate of water infiltration. Returning crop residue to the soil, adding other organic material, and minimizing tillage increase the infiltration rate and help to maintain good tilth. Winter wheat and hay crops are subject to frost heave in some years.

If this soil is used as a site for dwellings, the seasonal wetness and the shrink-swell potential are limitations. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the footings lowers the water table. Elevating the floor of dwellings without basements above the surrounding ground level, grading, and diverting surface water also help to overcome the wetness.

The seasonal wetness and the very slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed. A sewage lagoon is an alternative method of waste disposal.

The land capability classification is IIIw.

3B—Hoyleton silt loam, 1 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on low, undulating knolls, mounds, and ridges on loess-covered till plains. Individual areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 3 inches thick. The subsoil extends to a depth of more than 60 inches. It is mottled. The upper part is yellowish brown silt loam, the next part is pale brown and light brownish gray silty clay loam, and the lower part is brown and light brownish gray silty clay loam high in content of sand. In some areas the surface layer is lighter in color.

Included with this soil in mapping are small areas of the poorly drained Cisne soils at the head of drainageways and in depressions. These soils make up 5 to 10 percent of the unit.

Water and air move through the Hoyleton soil at a slow rate. Surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet from March through June in most years. Available water capacity is high. The surface layer typically is neutral because of past liming practices but is medium acid to very strongly acid if not limed. The subsoil is medium acid to very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is high in the subsoil.

Most areas are cultivated. This soil is well suited to cultivated crops, small grain, hay, and pasture. It is poorly suited to dwellings and septic tank absorption fields.

In the areas used for corn, soybeans, or small grain, erosion is a hazard unless the surface is protected. Also, the wetness can delay planting in some years. It can be reduced by surface ditches. Erosion can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting, by contour farming, or by terraces. Tilling when the soil is wet causes surface compaction and reduces the rate of water infiltration. Returning crop residue to the soil and regularly adding other organic material increase the infiltration rate and improve tilth.

If this soil is used as a site for dwellings, the seasonal wetness and the high shrink-swell potential are limitations. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the footings helps to lower the water table.

The seasonal wetness and the slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed. Sewage lagoons function satisfactorily if the site is leveled.

The land capability classification is IIe.

8E2—Hickory loam, 15 to 20 percent slopes, eroded. This moderately steep, well drained soil is on dissected till plains along drainageways and adjacent to bottom land. Individual areas are long and narrow or irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark brown loam about 3 inches thick. The subsurface layer is yellowish brown, friable loam about 3 inches thick. The subsoil extends to a depth of more than 60 inches. It is, in sequence downward, strong brown loam; strong brown and yellowish brown clay loam; yellowish brown, mottled clay loam; and yellowish brown, mottled loam. In some eroded areas at the head of drainageways, the surface layer is strong brown. In places the depth to the seasonal high water table is less than 5 feet.

Included with this soil in mapping are small areas of soils that are shallow to bedrock and some small areas of the moderately well drained Ava and Zanesville soils. The shallow soils are generally on the lower parts of the landscape, and Ava and Zanesville soils are on the higher parts. Included soils make up 8 to 15 percent of the unit.

Water and air move through the Hickory soil at a moderate rate. Surface runoff is rapid. Available water

capacity is high. The surface layer commonly is strongly acid. The subsoil is strongly acid or very strongly acid in the upper part and is less acid in the lower part. The shrink-swell potential is moderate in the subsoil.

Most areas are used as woodland. Some are used as pasture. This soil is well suited to woodland, moderately suited to pasture, and poorly suited to cultivated crops. It generally is unsuited to dwellings and septic tank absorption fields because of the slope.

Unless the surface is protected, further erosion is a severe hazard in the areas used for corn, soybeans, or small grain. It can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting and by contour farming and a cropping sequence that is dominated by forage crops. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and improve tilth.

Erosion control is needed when grasses and legumes are established in the pastured areas. In areas where the pasture is established, seeding legumes on the contour improves forage quality and helps to control erosion. A permanent cover of pasture plants helps to control erosion and maintains tilth. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. Logging roads and skid trails should be established on the contour. Logs or trees can be skidded uphill with a cable and winch. Surface water can be diverted from logging roads and skid trails with water bars. Firebreaks should be the grass type. Bare areas created by logging operations can be seeded to grass or to a grass-legume mixture. Operating machinery only during periods when the soil is firm enough to support the equipment helps to prevent the formation of ruts. When trees are planted in bare areas, a grass cover should be established between the rows. Also, the trees should be planted on the contour if a mechanical tree planter is used. Competing vegetation can be controlled by chemicals.

The land capability classification is IVe.

8E3—Hickory loam, 15 to 22 percent slopes, severely eroded. This moderately steep, well drained soil is on dissected till plains along drainageways and adjacent to bottom land. Individual areas are long and narrow or irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is yellowish brown loam about 10 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is yellowish brown, mottled clay loam, and the lower part is brownish yellow, mottled loam. In some uneroded areas the surface layer is dark brown loam. In other areas bedrock is within a depth of 5 feet.

Included with this soil in mapping are small areas of the moderately well drained Ava soils and small areas of Wellston and Zanesville soils. Ava soils are on the upper parts of the slopes and on narrow ridges between drainageways. They have a brittle layer in the lower part of the subsoil. Wellston and Zanesville soils are shallower to bedrock than the Hickory soil. They are at the base of some slopes or at the head of some drainageways. Also included are some areas of soils that have more mottles and more clay in the subsoil than the Hickory soil. These soils are on the upper part of the slopes. Included soils make up less than 15 percent of the unit.

Water and air move through the Hickory soil at a moderate rate. Surface runoff is rapid. Available water capacity is high. The surface layer commonly is strongly acid. The subsoil is strongly acid or very strongly acid in the upper part and becomes less acid with increasing depth. The shrink-swell potential is moderate in the subsoil.

Most of the acreage is used as pasture or is brushy, idle land. Some areas are cultivated. This soil is well suited to woodland and moderately suited to pasture. It generally is unsuited to cultivated crops and to dwellings and septic tank absorption fields because of the slope.

Erosion control is needed when grasses and legumes are established in the pastured areas. In areas where the pasture is established, seeding legumes on the contour improves forage quality and helps to control erosion. A permanent cover of pasture plants helps to control erosion and maintains tilth. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

If this soil is used as woodland, protection from fire and grazing is essential. Logging roads and skid trails should be established on the contour if possible. Logs or trees can be skidded uphill with a cable and winch. Surface water can be diverted from logging roads and skid trails with water bars. Firebreaks should be the grass type. All bare areas created by logging operations should be seeded to grass or to a grass-legume mixture. Operating machinery only during periods when the soil is firm enough to support the equipment helps to prevent the formation of ruts. If trees are planted in bare areas, a grass cover should be established between the rows. Also, the trees should be planted on the contour if a mechanical tree planter is used. Competing vegetation can be controlled by chemicals.

The land capability classification is VIe.

8F—Hickory loam, 20 to 35 percent slopes. This steep, well drained soil is on dissected till plains along drainageways and adjacent to bottom land. Individual areas are long and narrow or irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The subsurface layer is dark yellowish brown, friable loam about 3 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is yellowish brown clay loam, and the lower part is yellowish brown, mottled loam. In some eroded areas the surface layer is thinner.

Included with this soil in mapping are small areas of the somewhat poorly drained Belknap and moderately well drained Sharon soils on bottom land and small areas of the moderately well drained Ava and Zanesville soils on narrow ridges and on the upper side slopes. Also included are a few areas of soils that are shallow to bedrock. Included soils make up 5 to 15 percent of the unit.

Water and air move through the Hickory soil at a moderate rate. Surface runoff is rapid. Available water capacity is high. The surface layer commonly is strongly or very strongly acid. The subsoil is strongly acid or very strongly acid in the upper part and becomes less acid with increasing depth.

Most areas are used as woodland. Some are used as pasture. This soil is well suited to woodland and moderately suited to pasture. It generally is unsuited to cultivated crops and to dwellings and septic tank absorption fields because of the slope.

Erosion control is needed when grasses and legumes are established in the pastured areas. In areas where the pasture is established, seeding legumes on the contour improves forage quality and helps to control erosion. A permanent cover of pasture plants helps to control erosion and maintains tilth. Operating machinery is difficult on the steeper slopes. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. Logging roads and skid trails should be established on the contour. Logs or trees can be skidded uphill with a cable and winch. Surface water can be diverted from logging roads and skid trails with water bars. Firebreaks should be the grass type. Bare areas created by logging operations can be seeded to grass or to a grass-legume mixture. Operating machinery only during periods when the soil is firm enough to support the equipment helps to prevent the formation of ruts. When trees are planted in bare areas, a grass cover should be established between the rows. Also, the trees should be planted on the contour if a mechanical tree planter is used. Competing vegetation can be controlled by chemicals.

The land capability classification is VIe.

12—Wynoose silt loam. This nearly level or slightly depressional, poorly drained soil is on broad, loess-covered till plains. In the lower areas it is ponded for brief periods from March through June. Individual areas are irregularly shaped and range from 2 to 20 acres in size.

Typically, the surface layer is grayish brown silt loam about 7 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 10 inches thick. The subsoil extends to a depth of more than 60 inches. It is grayish brown, mottled silty clay loam in the upper part; light brownish gray, mottled silty clay in the next part; and light brownish gray, mottled silt loam in the lower part.

Included with this soil in mapping are small areas of the somewhat poorly drained Bluford soils on broad ridges and knolls and on narrow ridges between drainageways. These soils make up 5 to 10 percent of the unit.

Water and air move through the Wynoose soil at a very slow rate. Surface runoff is slow or ponded. A seasonal high water table ranges from 0.5 foot above the surface to 1.0 foot below from March through June in most years. Available water capacity is moderate. Reaction in the surface layer may be very strongly acid but varies because of local liming practices. The subsoil is strongly acid or extremely acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains. The shrink-swell potential is high in the subsoil.

Most areas are cultivated. This soil is moderately suited to cultivated crops. It is poorly suited to dwellings and septic tank absorption fields.

This soil is sufficiently drained for corn, soybeans, or small grain. Measures that maintain or improve the drainage system are needed. A combination of surface ditches and land leveling reduces the wetness. Tilling when the soil is wet causes surface compaction and decreases the rate of water infiltration. Returning crop residue to the soil, adding other organic material, and minimizing tillage increase the rate of water infiltration and help to maintain good tilth.

A cover of pasture plants or hay improves tilth. The wetness limits the choice of plants and the period of grazing or cutting. Shallow ditching and land smoothing are helpful in reducing the wetness. Applications of fertilizer, applications of lime in areas where the surface soil is medium acid or very strongly acid, weed control, pasture rotation, proper stocking rates, timely harvesting, and timely deferment of grazing help to keep the pasture or hayland in good condition.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the footings helps to lower the water table. Elevating the floor of dwellings without basements above the surrounding ground level, grading, and diverting surface water also help to overcome the wetness.

The seasonal wetness and the very slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed.

The land capability classification is IIIw.

13A—Bluford silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on broad loess-covered till plains. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsurface layer is pale brown, mottled silt loam about 5 inches thick. The subsoil extends to a depth of more than 60 inches. It is mottled. The upper part is yellowish brown and pale brown silt loam, the next part is light brownish gray and yellowish brown silty clay loam, and the lower part is yellowish brown, brittle silt loam. In some areas, the subsurface layer is thicker and the subsoil contains less clay. In places the subsurface layer and the upper part of the subsoil have no gray colors.

Included with this soil in mapping are small areas of the poorly drained Racoon soils in slight depressions and at the head of drainageways. These soils have less clay in the subsoil than the Bluford soil. They are occasionally ponded. They make up 8 to 10 percent of the unit.

Water and air move through the upper part of the Bluford soil at a moderately slow rate and through the lower part at a slow rate. Surface runoff is slow. A seasonal high water table is at a depth of 1 to 3 feet from March through June in most years. Available water capacity is high. The surface layer typically is slightly acid because of past liming practices but is very strongly acid or strongly acid if not limed. The subsoil is strongly acid to extremely acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust and puddle, however, after hard rains. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. Some are used as sites for dwellings and septic tank absorption fields. This soil is well suited to cultivated crops. It is poorly suited to dwellings and septic tank absorption fields.

In the areas used for soybeans, corn, or small grain, the wetness delays planting in most years. It can be reduced, however, by surface ditches or subsurface drains. Erosion is a hazard in areas where slopes are very long. It can be controlled, however, by a system of conservation tillage that leaves crop residue on the surface after planting. Tilling when the soil is wet causes surface compaction, reduces the rate of water infiltration, and causes excessive runoff. Returning crop residue to the soil and regularly adding other organic material increase the infiltration rate and improve tilth.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the footings helps to lower the water table.

The seasonal wetness and the slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed. Sewage lagoons function well on this soil.

The land capability classification is IIw.

13B—Bluford silt loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on broad ridges on loess-covered till plains. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsurface layer is pale brown, mottled silt loam about 7 inches thick. The subsoil to a depth of more than 60 inches is mottled silty clay loam. The upper part is pale brown and light brownish gray, and the lower part is brown and brittle. In some eroded areas the surface layer is silty clay loam because it has been mixed with the upper part of the subsoil through cultivation. In places the subsurface layer is thicker.

Included with this soil in mapping are small areas of the poorly drained Racoon soils in slight depressions. These soils make up 2 to 10 percent of the unit.

Water and air move through the upper part of the Bluford soil at a moderately slow rate and through the lower part at a slow rate. Surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet from March through June in most years. Available water capacity is high. The surface layer commonly is medium acid but is slightly acid or neutral if limed. The subsoil is strongly acid or very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust and puddle, however, after hard rains. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. Some are used as sites for dwellings and septic tank absorption fields. This soil is well suited to cultivated crops. It is poorly suited to dwellings and septic tank absorption fields.

This soil is sufficiently drained for corn, soybeans, and small grain. The wetness delays planting, however, in most years. Unless the surface is protected, erosion is a hazard. It can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting and by contour farming or terraces. Tilling when the soil is wet causes surface compaction and reduces the rate of water infiltration. Returning crop residue to

the soil and regularly adding other organic material increase the infiltration rate and improve tilth.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the footings helps to lower the water table.

The seasonal wetness and the slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed. Sewage lagoons function satisfactorily if the site is leveled.

The land capability classification is IIe.

13B2—Bluford silt loam, 3 to 6 percent slopes, eroded. This gently sloping, somewhat poorly drained soil is on knolls and the sides of small drainageways on loess-covered till plains. Individual areas are irregular in shape and range from 2 to 50 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. It is yellowish brown and mottled. The upper part is silty clay loam, and the lower part is brittle silt loam. In uneroded areas the surface layer is darker.

Included with this soil in mapping are small areas of the moderately well drained Ava soils in the higher landscape positions. Also included are small areas of alluvial soils in drainageways that are subject to flooding. Included soils make up about 10 percent of the unit.

Water and air move through the upper part of the Bluford soil at a moderately slow rate and through the lower part at a slow rate. Surface runoff is medium. A seasonal high water table is at a depth of 1 to 3 feet during March through June in most years. Available water capacity is high. The surface layer typically is slightly acid because of past liming practices but is very strongly acid or strongly acid if not limed. The subsoil is strongly acid or very strongly acid. The surface layer tends to crust and puddle after hard rains because it generally contains subsoil material. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. Some are used for pasture and hay. Some are used as sites for dwellings and septic tank absorption fields. This soil is well suited to cultivated crops and to pasture and hay. It is poorly suited to dwellings and septic tank absorption fields.

This soil is sufficiently drained for corn, soybeans, and small grain. The wetness delays planting, however, in most years. Also, further erosion is a hazard. It can be controlled, however, by a system of conservation tillage that leaves crop residue on the surface after planting and by contour farming or terraces. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and improve tilth.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the footings helps to lower the water table.

The seasonal wetness and the slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or a evapotranspiration bed are installed. Sewage lagoons function satisfactorily if the site is leveled.

The land capability classification is IIe.

14B—Ava silt loam, 1 to 5 percent slopes. This gently sloping, moderately well drained soil is on the convex tops of ridges on loess-covered till plains. Individual areas are linear and range from 2 to 20 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark yellowish brown and yellowish brown silt loam; the next part is yellowish brown, mottled silty clay loam; and the lower part is yellowish brown, brittle silty clay loam and brownish yellow, brittle silt loam. In some areas the subsoil is redder and is less brittle.

Included with this soil in mapping are small areas of the somewhat poorly drained Bluford soils at the head of drainageways and on concave side slopes. These soils contain more clay in the subsoil than the Ava soil. They make up 2 to 10 percent of the unit.

Water and air move through the upper part of the Ava soil at a moderately slow rate and through the lower part at a very slow rate. Surface runoff is medium. A perched seasonal high water table is at a depth of 2 to 4 feet from March through June in most years. Available water capacity is high. The surface layer commonly is slightly acid because of past liming practices but in some areas is very strongly acid. The subsoil is extremely acid to strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. Some are used as sites for dwellings and septic tank absorption fields. This soil is well suited to cultivated crops, pasture, and hay. It is moderately suited to dwellings without basements and poorly suited to dwellings with basements and to septic tank absorption fields.

Measures that control erosion are needed in the areas used for soybeans, corn, or small grain. Examples are a system of conservation tillage that leaves crop residue on the surface after planting, contour farming, and terraces. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material help to maintain tilth and fertility.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. The wetness is a more severe limitation on sites for dwellings with basements than on sites for dwellings without basements. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the foundations lowers the water table.

The seasonal wetness and the very slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed. Sewage lagoons function satisfactorily if the site is leveled.

The land capability classification is IIe.

14B2—Ava silt loam, 2 to 5 percent slopes, eroded. This gently sloping, moderately well drained soil is on narrow ridgetops and short side slopes on loess-covered till plains. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. It is yellowish brown. The upper part is silt loam, the next part is mottled silty clay loam, and the lower part is brittle silty clay loam. In some areas the subsoil is redder and is less brittle. In other areas the slope is more than 5 percent. In uneroded areas the surface layer is darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Bluford soils at the head of the drainageways and on some of the lower slopes. These soils contain more clay in the subsoil than the Ava soil. Also included are severely eroded areas of sloping soils along drainageways. Included soils make up about 10 percent of the unit.

Water and air move through the upper part of the Ava soil at a moderately slow rate and through the lower part at a very slow rate. Surface runoff is medium. A perched seasonal high water table is at a depth of 2 to 4 feet from March through June in most years. Available water capacity is high. The surface layer commonly is slightly acid because of past liming practices but in some areas is very strongly acid. The subsoil is extremely acid to strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. Some are used as sites for dwellings and septic tank absorption fields. This soil is well suited to cultivated crops, pasture, and hay. It is moderately suited to dwellings without basements and poorly suited to dwellings with basements and to septic tank absorption fields.

Measures that control erosion are needed in the areas used for soybeans, corn, or small grain. Examples are a system of conservation tillage that leaves crop residue on the surface after planting, contour farming, and terraces (fig. 6). Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material help to maintain tilth and fertility.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. The wetness is a more severe limitation on sites for dwellings with basements than on sites for dwellings without basements. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the foundations lowers the water table.

The seasonal wetness and the very slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed. Sewage lagoons function satisfactorily if the site is leveled.

The land capability classification is IIe.

14C2—Ava silt loam, 5 to 10 percent slopes, eroded. This sloping, moderately well drained soil is on side slopes along drainageways and on some convex, narrow ridgetops on loess-covered till plains. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark yellowish brown silt loam about 4 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is yellowish brown silty clay loam; the next part is yellowish brown, mottled, brittle silt loam; and the lower part is brown, brittle silt loam. In some areas the subsoil is reddish and is not so brittle. In other places the surface layer is yellowish brown silty clay loam because it has been mixed with part of the subsoil through cultivation.

Figure 6.—A cover of crop residue in an area of Ava silt loam, 2 to 5 percent slopes, eroded.

Included with this soil in mapping are some areas of somewhat poorly drained soils along drainageways and near the base of slopes. These soils are often seepy in the spring and contain more clay in the subsoil than the Ava soil. Also included are some areas of soils that have sandstone residuum in the lower part of the subsoil. Included soils make up 5 to 10 percent of the unit.

Water and air move through the upper part of the Ava soil at a moderately slow rate and through the lower part at a very slow rate. Surface runoff is rapid. A perched seasonal high water table is at a depth of 2 to 4 feet from March through June in most years. Available water capacity is high. The surface layer typically is medium acid because of past liming practices but is very strongly acid if not limed. The subsoil is strongly acid or very strongly acid. The surface layer is friable, but it tends to crust or puddle after hard rains, especially in cultivated areas. The shrink-swell potential is moderate in the subsoil.

Most areas are used as pasture or woodland. Some are cultivated. This soil is moderately suited to cultivated crops, pasture, and hay and is well suited to woodland. It is moderately suited to dwellings without basements and poorly suited to dwellings with basements and to septic tank absorption fields.

Measures that control erosion are needed in the areas used for soybeans, corn, or small grain. Examples are a system of conservation tillage that leaves crop residue on the surface after planting, contour farming, or terraces, and a crop rotation that includes 1 or more years of forage crops. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and help to maintain tilth.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used for woodland, protection from fire and grazing is essential. Chemical or mechanical methods, or both, are needed to control competing vegetation when seedlings are becoming established.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. The wetness is a more severe limitation on sites for dwellings with basements than on sites for dwellings without basements. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the foundations lowers the water table.

The seasonal wetness and the very slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed.

The land capability classification is IIIe.

14C3—Ava silt loam, 5 to 10 percent slopes, severely eroded. This sloping, moderately well drained soil is on side slopes adjacent to drainageways on loess-covered till plains. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is mixed yellowish brown and brown silt loam about 5 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is yellowish brown silt loam; the next part is yellowish brown, brittle silty clay loam; and the lower part is mottled strong brown and dark brown, brittle silt loam. In some areas the subsoil contains more sand and some gravel.

Included with this soil in mapping are small areas of somewhat poorly drained soils at the head of drainageways and near the base of slopes. These soils contain more clay in the subsoil than the Ava soil. Also included are small areas of soils that formed in silty alluvial material along drainageways that are subject to flooding. Included soils make up 10 to 12 percent of the unit.

Water and air move through the upper part of the Ava soil at a moderately slow rate and through the lower part at a very slow rate. Surface runoff is rapid. A perched seasonal high water table is at a depth of 2 to 4 feet from March through June in most years. Available water capacity is high. The surface layer typically is medium acid because of past liming practices but is very strongly acid if not limed. The subsoil is strongly acid or very strongly acid. The surface layer is firm. It tends to crust or puddle after hard rains, especially in cultivated areas, because it contains subsoil material. The shrink-swell potential is moderate in the subsoil.

Most areas are cultivated. This soil is poorly suited to cultivated crops and moderately suited to pasture and hay. It is moderately suited to dwellings without basements and poorly suited to dwellings with basements and to septic tank absorption fields.

Unless the surface is protected, further erosion is a severe hazard in the areas used for soybeans, corn, or small grain. It can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting, contour farming or terraces, and a crop rotation that is dominated by forage crops. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and help to maintain tilth.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. The wetness is a more severe limitation on sites for dwellings with basements than on sites for dwellings without basements. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the foundations lowers the water table.

The seasonal wetness and the very slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed.

The land capability classification is IVe.

14D3—Ava silt loam, 10 to 18 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on the sides and at the heads of drainageways on loess-covered till plains. Individual areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is mixed yellowish brown and brown silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. It is mottled. The upper part is brown silt loam, the next part is strong brown silty clay loam and silt loam, and the lower part is brown, brittle silt loam. In uneroded areas the surface layer is darker. In other areas the middle and lower parts of the subsoil formed in loamy glacial till. In places the surface layer is silty clay loam because it has been mixed with part of the subsoil through cultivation.

Included with this soil in mapping are small areas of Hickory and Zanesville soils. The well drained, moderately permeable Hickory soils are on the steeper slopes. Zanesville soils are underlain by bedrock within a depth of 60 inches. They are in landscape positions similar to those of the Ava soil. Also included are small areas of alluvial soils along drainageways that are subject to flooding. Included soils make up 10 to 15 percent of the unit.

Water and air move through the upper part of the Ava soil at a moderately slow rate and through the lower part at a very slow rate. Surface runoff is rapid. A perched seasonal high water table is at a depth of 2 to 4 feet from March through June in most years. Available water capacity is high. The surface layer typically is medium

acid because of past liming practices but is very strongly acid if not limed. The subsoil is strongly acid or very strongly acid. The surface layer is friable, but it tends to crust or puddle after hard rains, especially in cultivated areas, because it contains subsoil material. The shrink-swell potential is moderate in the subsoil.

Most areas are cultivated or formerly were cultivated. Some are idle and are reverting back to trees. Some areas are used as pasture. This soil is moderately suited to pasture and hay and well suited to woodland. It is moderately suited to dwellings without basements and poorly suited to cultivated crops, dwellings with basements, and septic tank absorption fields.

Measures that control erosion are needed in the areas used for soybeans, corn, or small grain. Examples are a system of conservation tillage that leaves crop residue on the surface after planting, contour farming or terraces, and a crop rotation that is dominated by forage crops. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and help to maintain tilth.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. Chemical or mechanical methods, or both, are needed to control competing vegetation when seedlings are becoming established.

The seasonal wetness and the slope are limitations if this soil is used as a site for dwellings. The wetness is a more severe limitation on sites for dwellings with basements than on sites for dwellings without basements. Installing subsurface drains around the foundations lowers the water table. Cutting and filling help to overcome the slope.

The seasonal wetness and the very slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed.

The land capability classification is IVe.

72—Sharon silt loam. This nearly level, moderately well drained soil is on bottom land. It is frequently flooded for brief periods from March through May. Individual areas are long and narrow and range from 5 to 80 acres in size.

Typically, the surface layer is yellowish brown silt loam about 18 inches thick. The underlying material to a depth of about 60 inches is silt loam. It is brown in the upper part and mixed brown, grayish brown, and dark brown and mottled in the lower part. Some small areas are gently sloping. In places the lower part of the underlying material contains rock fragments. In some areas sandstone or shale bedrock is within a depth of 60 inches. In other areas strata of loam or sandy loam are in the underlying material.

Included with this soil in mapping are small areas of the somewhat poorly drained Belknap soils on the lower parts of the bottom land and where small drainageways join the larger flood plains. These soils make up 2 to 10 percent of the unit.

Water and air move through the Sharon soil at a moderate rate. Surface runoff is slow. A seasonal high water table is at a depth of 3 to 6 feet from March through June in most years. Available water capacity is very high. The surface layer commonly is very strongly acid but is less acid where limed. The underlying material is strongly acid or very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are cultivated. Some small areas are used as pasture or woodland. This soil is well suited to cultivated crops and pasture. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

In the areas used as cropland, the flooding is a hazard but occurs less often than once in 2 years during the growing season. Erosion or scouring during floods is a hazard if the soil is cultivated. Avoiding fall cultivation and establishing grass strips in critical areas reduce this hazard. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Minimizing tillage and returning crop residue to the soil help to maintain good tilth and increase the rate of water infiltration.

A cover of grasses improves tilth and helps to control erosion or scouring during floods. Selection of suitable species for planting, proper stocking rates, applications of fertilizer, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

108—Bonnie silt loam. This nearly level, poorly drained soil is in broad, low lying areas on bottom land. It is frequently flooded for long periods and in the lower areas is ponded for brief periods from March through May. Individual areas are irregular in shape and range from 5 to 500 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The underlying material to a depth of more than 60 inches is mottled silt loam. The upper part is light brownish gray, and the lower part is light gray. In some areas the soil is silty clay loam throughout.

Included with this soil in mapping are small areas of Racoon soils on low stream terraces. These soils have a silty clay loam subsoil. Also included are small areas of the somewhat poorly drained Banlic and Belknap soils on slight rises and small areas near upland slopes where

the soil has high concentrations of salts. Included soils make up 5 to 10 percent of the unit.

Water and air move through the Bonnie soil at a moderately slow rate. Surface runoff is slow or ponded. A seasonal high water table is 0.5 foot above the surface to 1.0 foot below from March through June in most years. Available water capacity is very high. The surface layer commonly is medium acid because of past liming practices, but in some areas it is strongly acid. The underlying material is strongly acid or very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. Some are used as woodland. This soil is moderately suited to cultivated crops and well suited to woodland. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

This soil is sufficiently drained for soybeans and corn. The flooding is a hazard but occurs less often than once in 2 years during the growing season. Measures that maintain the drainage system are needed. Wetness can be reduced by surface ditches or subsurface drains. Tilling when the soil is wet causes surface cloddiness and compaction. Minimizing tillage and returning crop residue to the soil help to maintain good tilth and increase the rate of water infiltration.

In the areas used as woodland, protection from fire and grazing is essential. The seedling mortality rate can be reduced by selecting planting stock that is larger than is typical or by mulching. Some replanting may be needed. Harvesting methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Competing vegetation can be controlled by chemicals or mechanical methods, or both.

The land capability classification is IIIw.

109—Racoon silt loam. This nearly level, poorly drained soil is on stream terraces, in upland depressions, and on low lying uplands bordering flood plains. The lower areas are ponded for brief periods from March through June. Individual areas are irregularly shaped and range from 5 to 200 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsurface layer is grayish brown and light grayish brown, mottled silt loam about 17 inches thick. The subsoil to a depth of more than 60 inches is light brownish gray, mottled silty clay loam. In places silty clay loam lacustrine sediments underlie 20 to 35 inches of silty alluvial deposits.

Included with this soil in mapping are small areas of the poorly drained Bonnie soils along drainageways and the somewhat poorly drained Bluford and Creal soils on the higher parts of the landscape. Also included are small areas of Wynoose soils. These soils have more clay in the subsoil than the Racoon soil and have a thinner subsurface layer. Also, they are higher or lower on the landscape. Included soils make up 2 to 10 percent of the unit.

Water and air move through the Racoon soil at a slow rate. Surface runoff is slow. A seasonal high water table is 0.5 foot above the surface to 1.0 foot below from March through June in most years. Available water capacity is high. Reaction in the surface layer commonly is medium acid but varies because of local liming practices. The subsoil is strongly acid to extremely acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains. The shrink-swell potential is high in the subsoil.

Most areas are used for cultivated crops. Some small areas are used as woodland. This soil is moderately suited to cultivated crops and woodland. It is generally unsuited to dwellings and septic tank absorption fields because of the ponding.

This soil is sufficiently drained for corn, soybeans, and small grain. Measures that maintain or improve the drainage system are needed in some areas. Drainage can be improved by diversions and surface ditches. Tilling when the soil is wet causes surface compaction and decreases the rate of water infiltration. Minimizing tillage and returning crop residue to the soil increase the infiltration rate and help to maintain good tilth.

In the areas used as woodland, protection from fire and grazing is essential. The seedling mortality rate can be reduced by selecting planting stock that is larger than is typical or by mulching. Some replanting may be needed. Harvesting methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Competing vegetation can be controlled by chemicals or mechanical methods, or both.

The land capability classification is IIIw.

173A—McGary silt loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on stream terraces. Individual areas are oval and range from 2 to 100 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is about 38 inches thick. It is mottled. The upper part is brown silty clay loam, the next part is grayish brown silty clay, and the lower part is grayish brown silty clay loam. The underlying material to a depth of about 60 inches is light olive brown silt loam and silty clay loam. In some areas the upper part of the subsoil is more acid. In other areas, the underlying material is closer to the surface and the soil is stratified with loamy material.

Included with this soil in mapping are small areas of poorly drained soils in drainageways and slight depressions. Also included are small areas of eroded soils on the sloping edges of the terraces. Included soils make up 5 to 10 percent of the unit.

Water and air move through the McGary soil at a slow rate. Surface runoff is slow. A seasonal high water table

is at a depth of 1 to 3 feet from January through April in most years. Available water capacity is moderate. The surface layer typically is neutral because of past liming practices but is medium acid or strongly acid if not limed. The subsoil is neutral or slightly acid, and the underlying material is mildly alkaline. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust and puddle, however, after hard rains. The shrink-swell potential is high in the subsoil.

Most areas are cultivated. This soil is well suited to cultivated crops. It is poorly suited to dwellings and septic tank absorption fields.

In the areas used for corn, soybeans, or small grain, the wetness delays planting in some years. It can be reduced, however, by surface ditches. Unless the surface is protected, erosion is a hazard in the more sloping areas. It can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material help to maintain tilth and fertility.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. Foundation drains lower the water table. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling.

The slow permeability and the seasonal wetness are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed.

The land capability classification is IIw.

288—Petrolia silty clay loam. This nearly level, poorly drained soil is on bottom land. It is occasionally flooded for brief to long periods and in the lower areas is ponded for brief periods from March through June. Individual areas are long and narrow or circular and range from 10 to 160 acres in size.

Typically, the surface layer is grayish brown silty clay loam about 8 inches thick. The underlying material to a depth of about 60 inches is mottled silty clay loam. It is grayish brown in the upper part, light brownish gray in the next part, and gray in the lower part. In some areas the underlying material contains more clay in the lower part, and in other areas it is strongly acid. In places the soil is silt loam throughout.

Included with this soil in mapping are small areas of Zipp soils in depressions and old slough channels. These soils contain more clay than the Petrolia soil. Also included are small areas of the somewhat poorly drained Belknap soils on the slightly higher parts of the landscape. Included soils make up 8 to 10 percent of the unit.

Water and air move through the Petrolia soil at a moderately slow rate. Surface runoff is slow or ponded. A seasonal high water table is 0.5 foot above the surface to 3.0 feet below from April through June. Available water capacity is high. Reaction in the surface layer commonly is slightly acid but varies because of local liming practices. The subsoil is medium acid to neutral. The surface layer is firm and tends to crust and puddle after hard rains. The shrink-swell potential is moderate in the subsoil.

Most areas are cultivated. This soil is well suited to cultivated crops and moderately suited to pasture and hay. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

This soil is sufficiently drained for soybeans and corn. Measures that maintain or improve the drainage system are needed. Surface ditches or subsurface drains reduce the wetness. The flooding is a hazard but occurs only occasionally during the growing season. Soil blowing also is a hazard. It can be controlled, however, by leaving crop residue on the surface and by establishing windbreaks. Tilling when the soil is wet causes surface cloddiness and compaction. Minimizing tillage and returning crop residue to the soil improve tilth and increase the rate of water infiltration.

Including grasses and legumes in the cropping sequence helps to maintain tilth. Selection of suitable species for planting, proper stocking rates, applications of fertilizer, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIw.

301B2—Grantsburg silt loam, 2 to 5 percent slopes, eroded. This gently sloping, moderately well drained soil is on the crests of ridges, knolls, and short side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is strong brown and yellowish brown silt loam, the next part is yellowish brown and strong brown silty clay loam, and the lower part is yellowish brown, mottled, brittle silt loam. In some areas the soil is deeper to the brittle layer. In other areas the surface layer is darker. In places the lower part of the subsoil formed in glacial till.

Included with this soil in mapping are small areas of more poorly drained soils in slight depressions and at the head of some drainageways. These soils make up 2 to 8 percent of the unit.

Water and air move through the upper part of the Grantsburg soil at a moderately slow rate and through the lower part at a very slow rate. Surface runoff is medium. A perched seasonal high water table is at a depth of 1 to 2 feet from February through April in most years. Available water capacity is moderate. The surface layer commonly is slightly acid or medium acid because

of past liming practices but in some areas is very strongly acid. The subsoil is strongly acid or very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust and puddle, however, after hard rains. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops. Many of the narrow ridgetops are wooded or occur as brushy, idle land. This soil is well suited to cultivated crops (fig. 7). It is poorly suited to dwellings and septic tank absorption fields.

Measures that control erosion are needed in the areas used for soybeans, corn, and small grain. Examples are a system of conservation tillage that leaves crop residue on the surface after planting, contour farming, and terraces. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material help to maintain tilth and fertility.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. The seedling mortality rate can be reduced by selecting planting stock that is larger than is typical or by mulching. Some replanting may be needed. Harvesting methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Competing vegetation can be controlled by chemicals or mechanical methods, or both.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the foundations lowers the water table.

Figure 7.—A row cropped area of Grantsburg silt loam, 2 to 5 percent slopes, eroded. Wellston and Frondorf soils are in the background.

The seasonal wetness and the very slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed. Sewage lagoons function satisfactorily if the site is leveled.

The land capability classification is IIe.

301C2—Grantsburg silt loam, 5 to 12 percent slopes, eroded. This sloping, moderately well drained soil is on narrow ridgetops and some side slopes. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is yellowish brown and strong brown silty clay loam and silt loam. The next part is strong brown, mottled silty clay loam. The lower part is yellowish brown, mottled, brittle silt loam. In some areas bedrock is within 60 inches of the surface. In other areas the slope is more than 12 percent. In small severely eroded areas, the surface layer is yellowish brown and strong brown silty clay loam. In places the subsoil formed in glacial till.

Included with this soil in mapping are areas of somewhat poorly drained soils at the head of some drainageways. These soils make up 3 to 10 percent of the unit.

Water and air move through the upper part of the Grantsburg soil at a moderately slow rate and through the lower part at a very slow rate. Surface runoff is rapid. A perched seasonal high water table is at a depth of 1 to 2 feet from February through April in most years. Available water capacity is moderate. The surface layer typically is medium acid or strongly acid because of past liming practices but is very strongly acid if not limed. The subsoil is strongly acid or very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains. The shrink-swell potential is moderate in the subsoil.

Most areas are used as woodland or pasture. Some are cultivated. Some are used as sites for dwellings and septic tank absorption fields. This soil is well suited to woodland and moderately suited to cultivated crops, pasture, and hay. It is poorly suited to dwellings and septic tank absorption fields.

Measures that control erosion are needed in the areas used for soybeans, corn, or small grain. Examples are a system of conservation tillage that leaves crop residue on the surface after planting, contour farming or terraces, and a crop rotation that includes 1 or more years of forage crops. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and help to maintain tilth.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. The seedling mortality rate can be reduced by selecting planting stock that is larger than is typical or by mulching. Some replanting may be needed. Harvesting methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Competing vegetation can be controlled by chemicals or mechanical methods, or both.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the foundations lowers the water table.

The seasonal wetness, the very slow permeability, and the slope are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed and the site is leveled.

The land capability classification is IIIe.

301C3—Grantsburg silt loam, 5 to 12 percent slopes, severely eroded. This sloping, moderately well drained soil is on side slopes adjacent to drainageways. Individual areas are irregular in shape and are 5 to 50 acres in size.

Typically, the surface layer is strong brown silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is strong brown silty clay loam and silt loam, and the lower part is yellowish brown, mottled, brittle silt loam. In some areas, the lower part of the subsoil has sandstone fragments and bedrock is within a depth of 60 inches. In other areas the slope is more than 12 percent. In places the lower part of the subsoil formed in glacial till.

Included with this soil in mapping are small areas of somewhat poorly drained soils near drainageways that are seepy. Also included are small areas of alluvial soils in drainageways that are subject to flooding. Included soils make up about 10 to 15 percent of the unit.

Water and air move through the upper part of the Grantsburg soil at a moderately slow rate and through the lower part at a very slow rate. Surface runoff is rapid. A perched seasonal high water table is at a depth of 1 to 2 feet from February through April in most years. Available water capacity is moderate. The surface layer typically is medium acid or strongly acid because of past liming practices but is very strongly acid if not limed. The subsoil is strongly acid or very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or

puddle, however, after hard rains. The shrink-swell potential is moderate in the subsoil.

Most areas are cultivated. This soil is poorly suited to cultivated crops, moderately suited to pasture and hay, and well suited to woodland. It is poorly suited to dwellings and septic tank absorption fields.

Unless the surface is protected, further erosion is a severe hazard in the areas used for soybeans, corn, and small grain. It can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting, contour farming, terraces, and a crop rotation that is dominated by forage crops. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and help to maintain tilth.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. The seedling mortality rate can be reduced by selecting planting stock that is larger than is typical or by mulching. Some replanting may be needed. Harvesting methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Competing vegetation can be controlled by chemicals or mechanical methods, or both.

The seasonal wetness and the shrink-swell potential are limitations if this soil is used as a site for dwellings. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the foundations lowers the water table.

The seasonal wetness, the very slow permeability, and the slope are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed and the site is leveled.

The land capability classification is IVe.

337—Creal silt loam. This nearly level, somewhat poorly drained soil is on concave foot slopes where bottom land joins uplands and on stream terraces. Individual areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown and light brownish gray, mottled silt loam about 18 inches thick. The subsoil extends to a depth of about 60 inches. It is light brownish gray and mottled. The upper part is silty clay loam, and the lower part is silt loam. In some areas, the subsurface layer is thinner and the subsoil contains more clay. In places, the surface layer is darker and the subsoil has reddish mottles.

Included with this soil in mapping are small areas of the poorly drained Racoon soils in drainageways and depressions. Also included are small areas of Belknap and Banlic soils in drainageways and on alluvial fans that are subject to flooding. Included soils make up 8 to 10 percent of the unit.

Water and air move through the Creal soil at a moderately slow rate. Surface runoff is slow. A seasonal high water table is at a depth of 1 to 3 feet from February through May in most years. Available water capacity is very high. The surface layer typically is slightly acid because of past liming practices but is medium acid or strongly acid if not limed. The subsoil is slightly acid to very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust and puddle, however, after hard rains. Seepy spots are common. The shrink-swell potential is moderate in the subsoil.

Most areas are cultivated. This soil is well suited to cultivated crops and to hay and pasture. It is poorly suited to dwellings and septic tank absorption fields.

In the areas used for corn, soybeans, or small grain, the wetness delays planting in some years. It can be reduced, however, by surface ditches or subsurface drains. Tilling when the soil is wet causes surface cloddiness and compaction. Returning crop residue to the soil and regularly adding other organic material help to maintain tilth and fertility.

The seasonal wetness is a limitation if this soil is used as a site for dwellings. Also, the shrink-swell potential is a limitation on sites for dwellings without basements. Foundation drains lower the water table. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling.

The moderately slow permeability and the seasonal wetness are limitations if this soil is used as a septic tank absorption field. Tile drains help to lower the water table. Enlarging the absorption area helps to overcome the moderately slow permeability. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed.

The land capability classification is IIw.

339E—Wellston silt loam, 15 to 20 percent slopes. This moderately steep, well drained soil is on dissected uplands along the sides of drainageways. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam about 5 inches thick. The subsoil is about 40 inches thick. The upper part is yellowish brown and strong brown silt loam, and the lower part is strong brown channery and very channery loam. Sand-

stone and siltstone bedrock is at a depth of about 48 inches. In some areas the subsoil contains more sand, and in other areas it contains more clay. In some eroded areas the surface layer is yellowish brown. In other areas the depth to bedrock is more than 6 feet.

Included with this soil in mapping are small areas of loamy alluvial soils on narrow bottom land and small areas of Frondorf soils on the steeper slopes. Frondorf soils are shallower to bedrock than the Wellston soils. Also included are Zanesville soils on the upper side slopes and on some of the lower side slopes. These soils have brittle layers in the lower part of the subsoil. Included soils make up 10 to 15 percent of the unit.

Water and air move through the Wellston soil at a moderate rate. Surface runoff is rapid. Available water capacity is moderate. The surface layer is medium acid to very strongly acid. The subsoil is strongly acid or very strongly acid.

Most areas are used as woodland. Some are used as pasture. This soil is well suited to woodland and moderately suited to pasture. It is poorly suited to cultivated crops. It generally is unsuited to dwellings and septic tank absorption fields because of the slope.

Unless the surface is protected, erosion is a severe hazard in the areas used for corn, soybeans, or small grain. It can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting, by contour farming, or by a cropping sequence that is dominated by forage crops. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and improve tilth.

Erosion control is needed when grasses and legumes are established in the pastured areas. In areas where the pasture is established, seeding legumes on the contour improves forage quality and helps to control erosion. A permanent cover of pasture plants helps to control erosion and maintains tilth. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. Logging roads and skid trails should be established on the contour. Logs or trees can be skidded uphill with a cable and winch. Surface water can be diverted from logging roads and skid trails with water bars. Firebreaks should be the grass type. Bare areas created by logging operations can be seeded to grass or to a grass-legume mixture. Operating machinery only during periods when the soil is firm enough to support the equipment helps to prevent the formation of ruts. If trees are planted in bare areas, a grass cover should be established between the rows. Also, the trees should be planted on the contour if a mechanical tree planter is used. Competing vegetation can be controlled by chemicals.

The land capability classification is IVe.

339F—Wellston silt loam, 20 to 35 percent slopes. This steep, well drained soil is on dissected uplands along the sides of drainageways. Individual areas are irregular in shape and range from 3 to 35 acres in size.

Typically, the surface layer is brown silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam about 4 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown silt loam, the next part is strong brown silty clay loam, and the lower part is strong brown channery loam. Sandstone and siltstone bedrock is at a depth of about 52 inches. In some areas the subsoil contains more sand.

Included with this soil in mapping are small areas of Frondorf soils on the steeper slopes along drainageways. These soils are shallower to bedrock than the Wellston soil. Also included are Zanesville soils on the upper side slopes and small areas of rock outcrop. Zanesville soils have brittle layers in the lower part of the subsoil. Included soils make up 10 to 12 percent of the unit.

Water and air move through the Wellston soil at a moderate rate. Surface runoff is rapid. Available water capacity is moderate. The surface layer commonly is medium acid to very strongly acid. The subsoil is strongly acid or very strongly acid.

Most areas are used as woodland. Some are used as pasture. This soil is well suited to woodland and moderately suited to pasture. It generally is unsuited to cultivated crops, dwellings, and septic tank absorption fields because of the slope.

Erosion control is needed when grasses and legumes are established in the pastured areas. In areas where the pasture is established, seeding legumes on the contour improves forage quality and helps to control erosion. A permanent cover of pasture plants helps to control erosion and maintains tilth. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. Logging roads and skid trails should be established on the contour. Logs or trees can be skidded uphill with a cable and winch. Surface water can be diverted from logging roads and skid trails with water bars. Firebreaks should be the grass type. Bare areas created by logging operations can be seeded to grass or to a grass-legume mixture. Operating machinery only during periods when the soil is firm enough to support the equipment helps to prevent the formation of ruts. If trees are planted in bare areas, a grass cover should be established between the rows. Also, the trees should be planted on the contour if a mechanical tree planter is used. Competing vegetation can be controlled by chemicals.

The land capability classification is VIe.

340C3—Zanesville silt loam, 5 to 10 percent slopes, severely eroded. This sloping, moderately well drained soil is on side slopes adjacent to drainageways. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is mixed brown and yellowish brown silt loam about 4 inches thick. The subsoil is about 52 inches thick. The upper part is yellowish brown and brown silty clay loam, and the lower part is brown, mottled, brittle silt loam that contains sandstone fragments. Thinly bedded sandstone, siltstone, and shale bedrock is at a depth of about 56 inches. In some areas the lower part of the subsoil is less brittle and contains more clay. In other areas, the soil is deeper to bedrock and the lower part of the subsoil formed in glacial till.

Included with this soil in mapping are areas of somewhat poorly drained soils on the less sloping, upper slopes and on foot slopes. These soils make up 8 to 10 percent of the unit.

Water and air move through the upper part of the Zanesville soil at a moderate rate and through the lower part at a slow rate. Surface runoff is medium. A perched seasonal high water table is at a depth of 2 to 3 feet from December through April in most years. Available water capacity is moderate. The surface layer typically is medium acid because of past liming practices but is very strongly acid if not limed. The subsoil is strongly acid or very strongly acid. The surface layer is firm. It tends to crust or puddle after hard rains, especially in cultivated areas, because it contains subsoil material.

Most areas are cultivated. This soil is poorly suited to cultivated crops and moderately suited to pasture and hay. It is moderately suited to dwellings without basements and poorly suited to dwellings with basements and to septic tank absorption fields.

Unless the surface is protected, further erosion is a severe hazard in the areas used for soybeans, corn, or small grain. It can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting, contour farming or terraces, and a crop rotation that is dominated by forage crops. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and improve tilth.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

The seasonal wetness is a limitation if this soil is used as a site for dwellings. The wetness is a more severe limitation on sites for dwellings with basements than on sites for dwellings without basements. Installing subsurface drains around the foundations lowers the water table.

The seasonal wetness, the slow permeability, and the slope are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed and the site is leveled.

The land capability classification is IVe.

340D2—Zanesville silt loam, 10 to 18 percent slopes, eroded. This strongly sloping, moderately well drained soil is on the sides of drainageways in the uplands. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 4 inches thick. The subsurface layer is yellowish brown silt loam about 5 inches thick. The subsoil is about 47 inches thick. The upper part is strong brown silty clay loam, and the lower part is strong brown silt loam and yellowish brown channery silt loam. It is brittle. Thinly bedded sandstone, siltstone, and shale bedrock is at a depth of about 56 inches. In some areas the lower part of the subsoil formed in glacial till. In other areas the slope is more than 18 percent.

Included with this soil in mapping are small areas of the well drained, moderately permeable Wellston and Frondorf soils on the steeper slopes. These soils do not have brittle layers in the lower part of the subsoil. Frondorf soils are shallower to bedrock than the Zanesville soil. Included soils make up 10 to 15 percent of the unit.

Water and air move through the upper part of the Zanesville soil at a moderate rate and through the lower part at a slow rate. Surface runoff is rapid. A perched seasonal high water table is at a depth of 2 to 3 feet from December through April in most years. Available water capacity is moderate. Reaction in the surface layer typically is strongly acid but varies, depending on local liming practices. The subsoil is strongly acid or very strongly acid. The surface layer tends to crust and puddle after hard rains, especially in cultivated areas.

Most areas are used as woodland. Some are pastured. This soil is poorly suited to cultivated crops and moderately suited to pasture, hay, and woodland. It is moderately suited to dwellings without basements and poorly suited to dwellings with basements and to septic tank absorption fields.

Unless the surface is protected, further erosion is a hazard in the areas used for corn, soybeans, and small grain. It can be controlled by a cropping sequence that is dominated by forage crops. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material increase the rate of water infiltration and improve tilth.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely

deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. Chemical or mechanical methods, or both, are needed to control competing vegetation when seedlings are becoming established.

The seasonal wetness is a severe limitation if this soil is used as a site for dwellings with basements. On sites for dwellings without basements, the seasonal wetness and the slope are moderate limitations. Foundation drains lower the water table. Cutting and filling help to overcome the slope.

The seasonal wetness, the slow permeability, and the slope are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed and the site is leveled.

The land capability classification is IVe.

340D3—Zanesville silt loam, 10 to 18 percent slopes, severely eroded. This strongly sloping, moderately well drained soil is on the sides of drainageways in the uplands. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is yellowish brown silt loam about 3 inches thick. The subsoil is about 49 inches thick. The upper part is strong brown silty clay loam; the next part is strong brown, brittle silt loam; and the lower part is yellowish brown channery silt loam. Weathered sandstone and shale bedrock is at a depth of about 52 inches. In some areas the subsoil extends to a depth of more than 60 inches and is silty in the lower part. In other areas the lower part of the subsoil formed in glacial till.

Included with this soil in mapping are small areas of soils that are moderately deep to bedrock. These soils have a subsoil that is thinner than that of the Zanesville soil. Also, they are more sloping. Also included are narrow bands of alluvial soils along drainageways that are subject to flooding. Included soils make up about 10 percent of the unit.

Water and air move through the upper part of the Zanesville soil at a moderate rate and through the lower part at a slow rate. Surface runoff is rapid. A perched seasonal high water table is at a depth of 2 to 3 feet from December through April in most years. Available water capacity is moderate. The surface layer and subsoil are strongly acid or very strongly acid. The surface layer is friable. It tends to crust or puddle after hard rains, however, because it contains subsoil material.

Most areas have been cultivated in the past but are now idle or are reverting back to woodland. Some are used for pasture, and some have been planted to trees. This soil is generally unsuited to cultivated crops because of the hazard of further erosion. It is poorly suited to woodland and moderately suited to pasture and hay. It is moderately suited to dwellings without basements and poorly suited to dwellings with basements and to septic tank absorption fields.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

In the areas used as woodland, protection from fire and grazing is essential. The seedling mortality rate can be reduced by selecting planting stock that is larger than is typical or by mulching. Some replanting may be needed. Competing vegetation can be controlled by chemicals or mechanical methods, or both.

The seasonal wetness and the slope are limitations if this soil is used as as site for dwellings. The wetness is a more severe limitation on sites for dwellings with basements than on sites for dwellings without basements. Installing subsurface drains around the foundations lowers the water table. Cutting and filling help to overcome the slope.

The seasonal wetness, the very slow permeability, and the slope are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed and the site is leveled.

The land capability classification is VIe.

382—Belknap silt loam. This nearly level, somewhat poorly drained soil is on bottom land. It is occasionally flooded for brief to long periods from March through June. Individual areas commonly are long and narrow and range from 5 to 400 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The underlying material to a depth of about 60 inches is mottled silt loam. The upper part is grayish brown, and the lower part is light brownish gray.

Included with this soil in mapping are small areas of the poorly drained Bonnie soils in old slough channels and slight depressions. Also included are small areas of Banlic and Sharon soils on the slightly higher parts of the landscape. Banlic soils are brittle in the lower part of the subsoil. Sharon soils are moderately well drained. Included soils make up 5 to 10 percent of the unit.

Water and air move through the Belknap soil at a moderately slow rate. Surface runoff is slow. A seasonal high water table is at a depth of 1 to 3 feet from March through June in most years. Available water capacity is very high. The surface layer commonly is slightly acid because of past liming practices but in some areas is strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to cultivated crops and to hay and pasture. It

generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

In the areas used for soybeans, corn, or small grain, the wetness or the flooding delays planting in most years. Crops are occasionally damaged by flooding. The wetness can be reduced by surface ditches or subsurface drains. Tilling when the soil is wet causes surface cloddiness and excessive runoff and erosion. Returning crop residue to the soil and minimizing tillage help to maintain good tilth and increase the rate of water infiltration.

Including grasses and legumes in the cropping sequence helps to maintain tilth. Selection of suitable species for planting, proper stocking rates, applications of fertilizer, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

404—Titus silty clay loam. This nearly level, poorly drained soil is in glacial lakebeds. It is subject to rare flooding and in the lower areas is ponded for brief periods. Individual areas are irregular in shape and range from 200 to 500 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 13 inches thick. The subsoil to a depth of more than 60 inches is mottled silty clay loam. It is dark gray and dark grayish brown in the upper part and grayish brown in the lower part. In some areas the surface layer is not so dark.

Included with this soil in mapping are areas of Zipp soils. These soils are lighter colored than the Titus soil and contain more clay. They are in the slightly lower areas. They make up 5 to 10 percent of the unit.

Water and air move through the Titus soil at a slow rate. Surface runoff is slow. A seasonal high water table is 0.5 foot above the surface to 2.0 feet below from March through June in most years. Available water capacity is high. The surface layer is neutral. The subsoil is slightly acid to mildly alkaline. The surface layer is firm when moist and cannot be easily tilled.

Most areas are cultivated. This soil is moderately suited to cultivated crops. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

A drainage system has been installed in the areas used for soybeans, corn, or small grain. Measures that maintain the drainage system are needed. The wetness can be reduced by surface ditches. Tilling when the soil is wet causes surface cloddiness and compaction. Returning crop residue to the soil and minimizing tillage improve tilth and increase the rate of water infiltration.

The land capability classification is IIIw.

420—Piopolis silty clay loam. This nearly level, poorly drained soil is in broad, low lying areas on bottom land. It is occasionally flooded for long periods and in the lower areas is ponded for brief periods from March through June. Individual areas are irregular in shape and range from 10 to 300 acres in size.

Typically, the surface layer is grayish brown silty clay loam about 7 inches thick. The underlying material to a depth of more than 60 inches is silty clay loam. It is light brownish gray in the upper part and gray and mottled in the lower part. In some areas the surface layer is silt loam. In other areas the soil is silt loam throughout. In places the underlying material is silty clay in the lower part.

Included with this soil in mapping are small areas of Bonnie and Belknap soils along present or former drainageways. Belknap soils are on natural levees. Both soils typically are silt loam throughout. They make up 5 to 10 percent of the unit.

Water and air move through the Piopolis soil at a slow rate. Surface runoff is slow or ponded. A seasonal high water table is 0.5 foot above the surface to 3.0 feet below from March through June in most years. Available water capacity is high. The surface layer commonly is slightly acid because of past liming practices, but in some areas it is strongly acid. The underlying material is very strongly acid to mildly alkaline. The surface layer is friable but tends to crust and puddle after hard rains. The shrink-swell potential is moderate in the subsoil.

Most areas are cultivated. This soil is moderately suited to cultivated crops, pasture, and hay. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

This soil is sufficiently drained for soybeans, corn, or small grain. The flooding is a hazard but occurs only occasionally during the growing season. Measures that maintain the drainage system are needed. The wetness can be reduced by surface ditches. Soil blowing is a hazard. It can be controlled by leaving crop residue on the surface and by establishing field windbreaks. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Minimizing tillage and returning crop residue to the soil help to maintain good tilth and increase the rate of water infiltration.

Including grasses and legumes in the cropping sequence helps to maintain tilth. Selection of suitable species for planting, proper stocking rates, applications of fertilizer, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIIw.

467B2—Markland silt loam, 2 to 5 percent slopes, eroded. This gently sloping, moderately well drained soil is on convex ridgetops and the short side slopes of stream terraces. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is brown and yellowish brown silt loam about 8 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown silty clay loam, the next part is yellowish brown and pale

brown silty clay and silty clay loam, and the lower part is yellowish brown and pale brown, mottled silt loam. The underlying material to a depth of about 60 inches is yellowish brown, mottled silty clay loam. In places the upper part of the subsoil is more acid. In uneroded areas the surface layer is darker.

Included with this soil in mapping are small areas of the somewhat poorly drained McGary soils. These soils are slightly lower on the landscape than the Markland soil. Also included are severely eroded soils in the more sloping areas on terrace edges. These soils have a surface layer of silty clay loam. Included soils make up 10 to 15 percent of the unit.

Water and air move through the Markland soil at a slow rate. Surface runoff is medium. A perched seasonal high water table is at a depth of 3 to 6 feet during March and April in most years. Available water capacity is moderate. The surface layer typically is neutral but ranges to medium acid, depending on local liming practices. The subsoil is medium acid to moderately alkaline. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust and puddle after hard rains, however, especially in cultivated areas, because it contains subsoil material. The shrink-swell potential is high in the subsoil.

Most areas are cultivated. This soil is moderately suited to cultivated crops and to pasture. It is poorly suited to dwellings and septic tank absorption fields.

Unless the surface is protected, erosion is a hazard in the areas used for soybeans, corn, or small grain. It can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting and by contour farming or terraces. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and regularly adding other organic material help to maintain tilth and fertility.

A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

The shrink-swell potential and the seasonal wetness are limitations if this soil is used as a site for dwellings. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the foundations lowers the water table.

The seasonal wetness and the slow permeability are limitations if this soil is used as a septic tank absorption field. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed. Sewage lagoons function satisfactorily if the site is leveled.

The land capability classification is IIIe.

524—Zipp silty clay. This nearly level, poorly drained soil is on flood plains and in glacial lakebeds. It is occasionally flooded for brief periods and in the lower areas is ponded for brief periods from December through May. Individual areas are oval and range from 20 to 5,000 acres in size.

Typically, the surface layer is dark grayish brown silty clay about 6 inches thick. The subsoil is gray, mottled silty clay about 38 inches thick. The underlying material to a depth of about 60 inches is gray, mottled silty clay. In some large areas in the northeastern part of the county, the upper part of the subsoil is strongly acid. In some small areas the surface layer is very fine sandy loam.

Included with this soil in mapping are small areas of clayey soils in old slough channels that are frequently ponded and areas of Piopolis soils on natural levees along these channels. Piopolis soils are siltier and more acid than the Zipp soil. Included soils make up 8 to 10 percent of the unit.

Water and air move through the Zipp soil at a slow rate. Surface runoff is slow or ponded. A seasonal high water is 0.5 foot above the surface to 2.0 feet below from December through May in most years. Available water capacity is moderate. The surface layer is neutral. The subsoil is medium acid to neutral. The surface layer is very firm and cannot be easily tilled.

Most areas are used for cultivated crops. Some areas are used as woodland. This soil is well suited to woodland and moderately suited to cultivated crops. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

A drainage system has been installed in the areas used for soybeans, corn, or small grain. The flooding is a hazard but occurs only occasionally during the growing season. Measures that maintain the drainage system are needed. A combination of surface ditches and land leveling reduces the wetness. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and minimizing tillage improve tilth and increase the rate of water infiltration.

In the areas used as woodland, protection from fire and grazing is essential. The seedling mortality rate can be reduced by selecting planting stock that is larger than is typical or by mulching. Some replanting may be needed. Harvesting methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Competing vegetation can be controlled by chemicals or mechanical methods, or both.

The land capability classification is IIIw.

524+—Zipp very fine sandy loam, overwash. This nearly level, poorly drained soil is on flood plains and in glacial lakebeds. It is occasionally flooded for brief periods and in the lower areas is ponded for brief periods

from December through May. Individual areas are oval and range from 5 to 200 acres in size.

Typically, the surface layer is brown very fine sandy loam about 12 inches thick. The subsoil to a depth of more than 60 inches is gray, mottled silty clay. In places the surface layer is clayey.

Included with this soil in mapping are small areas of the silty Petrolia soils on the slightly higher parts of the landscape. These soils make up 8 to 10 percent of the unit.

Water and air move through the Zipp soil at a slow rate. Surface runoff is slow or ponded. A seasonal high water table is 0.5 foot above the surface to 2.0 feet below from December through May in most years. Available water capacity is moderate. The surface layer is neutral to medium acid. The subsoil is slightly acid to mildly alkaline. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for cultivated crops. A few small areas are used as woodland. This soil is well suited to woodland and moderately suited to cultivated crops. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

A drainage system has been installed in the areas used for soybeans, corn, or small grain. Measures that maintain the drainage system are needed. A combination of surface ditches and land leveling can reduce the wetness if drainage outlets are available. The flooding is a hazard but occurs only occasionally during the growing season. Tilling when the soil is wet causes surface cloddiness and compaction and excessive runoff and erosion. Returning crop residue to the soil and minimizing tillage help to maintain good tilth and increase the rate of water infiltration.

In the areas used as woodland, protection from fire and grazing is essential. The seedling mortality rate can be reduced by selecting planting stock that is larger than is typical or by mulching. Some replanting may be needed. Harvesting methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Competing vegetation can be controlled by chemicals or mechanical methods, or both.

The land capability classification is IIIw.

786F—Frondorf silt loam, 15 to 35 percent slopes. This steep, moderately deep, well drained soil is on dissected uplands along the sides of drainageways. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is brown silt loam about 3 inches thick. The subsurface layer is light yellowish brown silt loam about 3 inches thick. The subsoil is about 18 inches thick. The upper part is yellowish brown silt loam, and the lower part is strong brown channery and very channery loam. Thinly bedded sandstone, siltstone, and shale bedrock is at a depth of about 24 inches. In places the subsoil formed mostly in shale residuum and contains more clay.

Included with this soil in mapping are small areas of rock outcrop and small areas where stones are on the surface and the soil is shallow to bedrock. These areas are steeper than the Frondorf soil and are near streams. Also included, on narrow ridge crests, are areas where the subsoil is thicker and contains fewer rock fragments. Included areas make up 5 to 15 percent of the unit.

Water and air move through the Frondorf soil at a moderate rate. Surface runoff is rapid. Available water capacity is low. The root zone is 20 to 40 inches thick. The surface layer commonly is very strongly acid. The subsoil is strongly acid or very strongly acid.

Most areas are used as woodland. Some are used as pasture. This soil is moderately suited to pasture and woodland. It generally is unsuited to cultivated crops and to dwellings because of the slope and to septic tank absorption fields because of the slope and the depth to bedrock.

Erosion control is needed when grasses and legumes are established in the pastured areas. A permanent cover of pasture plants helps to control erosion and maintains tilth. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition. In areas where the pasture is established, seeding legumes on the contour improves forage quality and helps to control erosion.

In the areas used as woodland, protection from fire and grazing is essential. Logging roads and skid trails should be established on the contour. Logs or trees can be skidded uphill with a cable and winch. Surface water can be diverted from logging roads and skid trails with water bars. Firebreaks should be the grass type and should be established on the contour if possible. Bare areas created by logging operations can be seeded to grass or to a grass-legume mixture. Operating machinery only during periods when the soil is firm enough to support the equipment helps to prevent the formation of ruts. If trees are planted in bare areas, a grass cover should be established between the rows. Also, the trees should be planted on the contour if a mechanical tree planter is used. The seedling mortality rate can be reduced by planting in furrows, by selecting planting stock that is larger than is typical, or by mulching. Some replanting may be needed. Competing vegetation can be controlled by chemicals.

The land capability classification is VIe.

787—Banlic silt loam. This nearly level, somewhat poorly drained soil is on low terraces and alluvial fans on bottom land. It is occasionally flooded for brief periods from March through June. Individual areas commonly are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is brown

silt loam about 8 inches thick. The subsoil to a depth of more than 60 inches is mottled silt loam. The upper part is light brownish gray, and the lower part is light gray and brittle. In some areas the brittle layers are thinner. In other areas a seasonal high water table is within 1 foot of the surface, and in other areas it is at a depth of more than 3 feet.

Included with this soil in mapping are small areas of the poorly drained Bonnie and Racoon soils. These soils are in slight depressions and commonly are below seepy upland areas. They make up 10 to 12 percent of the unit.

Water and air move through the Banlic soil at a slow rate. Surface runoff is slow. A seasonal high water table is at a depth of 1 to 3 feet from January through June in most years. Available water capacity is moderate. The surface layer commonly is neutral because of past liming practices but is medium acid to very strongly acid if not limed. The subsoil is medium acid to very strongly acid. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. Root development is somewhat limited by the brittle subsoil.

Most areas are cultivated. This soil is well suited to cultivated crops and moderately suited to hay and pasture. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

In the areas used for soybeans, corn, or small grain, the wetness or the flooding delays planting in most years. The wetness can be reduced by surface ditches. The flooding is a hazard but occurs only occasionally during the growing season. Tilling when the soil is wet causes surface cloddiness and excessive runoff and erosion. Returning crop residue to the soil and minimizing tillage help to maintain good tilth and increase the rate of water infiltration.

Including grasses and legumes in the cropping sequence helps to maintain tilth. Selection of suitable species for planting, proper stocking rates, applications of fertilizer, and restricted use during wet periods help to keep the pasture and the soil in good condition.

The land capability classification is IIw.

801E—Orthents, silty, moderately steep. These somewhat poorly drained to well drained soils are mainly along the major drainage ditches, in areas where the landscape has been modified by filling and leveling. Individual areas are long and narrow and range from 5 to 100 acres in size. Slopes generally range from 8 to 25 percent.

Most areas of these soils are in the southeastern and northeastern parts of the county where extensive channel work has been done. About 65 percent of the unit is on side slopes and in ditch channels, and 35 percent is on narrow ridgetops. An area of lesser extent adjacent to a construction project is on a disturbed upland.

Typically, the individual horizons of these soils have been altered by mixing. The surface layer is yellowish brown silt loam about 3 inches thick. The upper part of the underlying material is dominantly brown and grayish brown silt loam and silty clay loam. It has yellowish brown layers. The lower part is mixed brown and light brownish gray silt loam and gravelly silt loam.

Included with these soils in mapping are a few small dumps and other nonsoil areas. Included areas make up less than 5 percent of the unit.

Water and air move through the Orthents at a moderate rate in many areas and at a slow rate in areas where heavy equipment has compacted the soils. Available water capacity is high or moderate. Reaction is slightly acid to mildly alkaline.

Most areas are moderately steep and are planted to grasses that are used for erosion control, streambank and levee stabilization, and wildlife habitat. The less sloping areas away from the channels are suited to and used for crop production. These soils are moderately suited to pasture and hay. They are unsuited to dwellings because they are near streams and, in a few areas, mining or construction projects.

If these soils are used for crops, pasture, or hay, initial treatment should include heavy applications of fertilizer. In the more sloping areas, special measures are needed to control erosion. Streambank erosion is a hazard. Small areas are flooded during the growing season. A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer help to keep the pasture and the soil in good condition.

These soils are not assigned to a land capability classification.

929D3—Ava-Hickory complex, 10 to 18 percent slopes, severely eroded. These strongly sloping soils are on side slopes along drainageways and on hillsides above bottom land. The moderately well drained Ava soil is on the upper parts of most slopes and on the lower part of a few slopes. The well drained Hickory soil is on the lower parts of most slopes. Individual areas are irregular in shape and range from 5 to 40 acres in size. They are 40 to 75 percent Ava soil and 25 to 60 percent Hickory soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the Ava soil has a surface layer of mixed dark yellowish brown and brown silt loam about 8 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is yellowish brown silt loam and silty clay loam, and the lower part is yellowish brown and brownish yellow, brittle silt loam. In some uneroded areas the surface layer is darker. Some areas are gullied.

Typically, the Hickory soil has a surface layer of brown loam about 8 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is yellow-

ish brown clay loam, and the lower part is strong brown loam. Some areas are gullied.

Included with these soils in mapping are small areas of somewhat poorly drained soils. These included soils have more clay in the subsoil than the Ava and Hickory soils. They are on the lower parts of slopes at the head of drainageways. Also included are narrow areas of alluvial soils along drainageways that are subject to flooding and small areas of soils that are shallow to bedrock or have a slope of more than 18 percent. The shallow and steeper soils are commonly near streams. Included soils make up 5 to 10 percent of the unit.

Water and air move through the Hickory soil and the upper part of the Ava soil at a moderate rate. They move through the lower part of the Ava soil at a very slow rate. Surface runoff is rapid on both soils. A perched seasonal high water table is at a depth of 2 to 4 feet in the Ava soil from March through June in most years. Available water capacity is high in both soils. The surface layer is commonly medium acid or strongly acid. The subsoil of the Ava soil is strongly acid or very strongly acid. That of the Hickory soil is neutral to very strongly acid. The surface layer of both soils tends to crust after heavy rains. The shrink-swell potential is moderate in the subsoil.

Most areas are used for cultivated crops or for pasture. Because of a hazard of further erosion, these soils are poorly suited to cultivated crops. They are moderately suited to pasture and well suited to woodland. The Ava soil is poorly suited to septic tank absorption fields and dwellings with basements. It is moderately suited to dwellings without basements. The Hickory soil is moderately suited to dwellings and septic tank absorption fields.

Unless the surface is protected, further erosion is a severe hazard in the areas used for soybeans, corn, or small grain. It can be controlled by a system of conservation tillage that leaves crop residue on the surface after planting, by contour farming, and by a crop rotation that includes 1 or more years of forage crops. Tilling when the soils are wet causes excessive runoff and erosion. Returning crop residue to the soils and regularly adding other organic material improve fertility.

The seasonal wetness and moderate shrink-swell potential of the Ava soil and the slope and moderate shrink-swell potential of the Hickory soil are limitations on sites for dwellings. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around the footings lowers the water table. Cutting and filling help to overcome the slope.

The seasonal wetness and very slow permeability of the Ava soil and the moderate permeability of the Hickory soil are limitations on sites for septic tank absorption fields. The slope also is a limitation. A septic tank system can function satisfactorily if a sealed sand filter and a disinfection tank or an evapotranspiration bed are installed and the site is leveled.

The land capability classification is IVe.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges from 0 to 5 percent. More detailed information about the criteria for prime farmland is available at local offices of the Soil Conservation Service.

About 201,600 acres in Hamilton County, or nearly 73 percent of the total acreage, meets the requirements for prime farmland. Associations 1, 3, 4, and 5, which are described under the heading "General Soil Map Units," have the highest percentage, but the prime farmland is throughout the county.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use

and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations, such as a seasonal high water table or frequent flooding during the growing season, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1978, an estimated 170,201 acres in Hamilton County was cropland, about 18,333 acres was permanent pasture, and 16,886 acres was woodland (*10*). The rest of the acreage was used for roads or was built-up land or other areas.

Maximum production of row crops has nearly been achieved on the soils in Hamilton County that are suitable for row cropping. The soils on the more sloping uplands have good potential for increased production of hay and pasture. This soil survey can be used as a guide to the latest management techniques that increase food production. It provides the resource data needed for land use planning. Land use planners and decision makers can use the information in this soil survey as a guide in making land use decisions that will ensure the orderly growth and development of towns and rural areas.

The main management concerns on the cropland and pasture in Hamilton County are erosion, drainage, droughtiness, fertility, and tilth.

Soil erosion is a major management concern on about 22 percent of the cropland and pasture in Hamilton County. Erosion is damaging in many ways. The productivity of most soils is reduced if the surface layer is eroded away and the subsoil is mixed into a plow layer. Loss of the surface layer is especially damaging on those soils having layers that limit root penetration. Such layers include the brittle layers in the lower part of the subsoil in Grantsburg, Ava, and Zanesville soils, the channery layer in Wellston and Frondorf soils, and the clayey subsoil in Bluford, Wynoose, and McGary soils.

Erosion can result in a deterioration of tilth in the surface soil and can reduce the rate of water intake. An eroded surface soil tends to become cloddy when tilled because it has a higher clay content than an uneroded surface soil and is low in organic matter content. Preparing a good seedbed is difficult and germination poor on eroded soils. These soils tend to puddle after hard rains and crust when they dry. As a result, the runoff rate is increased.

Erosion can result in pollution if the eroding sediment is allowed to enter streams, lakes, rivers, and road ditches. Removing this sediment is expensive. Management that controls erosion also reduces the extent of

sediment pollution and improves water quality for municipal use, recreation, and fish and other wildlife.

A good resource management system maintains or improves natural fertility, removes excess water, controls erosion, and maintains good tilth. Reducing the length of slopes with terraces or diversions and providing an adequate plant cover help to control erosion, increase the rate of water intake, and reduce the runoff rate. A cropping system that keeps a cover of plants or crop residue on the surface during critical rainfall periods helps to hold soil losses within tolerable limits and helps to maintain the productivity of the soil. Including grasses and legumes in the cropping sequence improves tilth and provides nitrogen for the following crop.

Contour farming, contour stripcropping, and terraces help to control erosion and reduce the rate of runoff. They may not be suitable, however, in some areas of Grantsburg, Zanesville, and Ava soils because of short, steep slopes and an irregular topography. Such practices are better suited to areas of Grantsburg, Ava, Bluford, and Hoyleton soils where slopes are smooth and uniform.

Zero-tillage helps to control erosion on sloping upland soils (fig. 8). On the gently sloping and nearly level Bluford, Creal, Hoyleton, Ava, and McGary soils, a conservation tillage system or a cropping system that provides an adequate plant cover helps to control erosion. These conservation systems help to prevent excessive soil loss by providing a protective cover of residue or plants, reducing the runoff rate, and increasing the rate of water intake. They are suitable on most of the tillable upland soils in the county.

Information about erosion control on each kind of soil in Hamilton County is in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Artificial drainage is needed on nearly 60,000 acres in Hamilton County. Some type of drainage system has been installed in most of these areas. Productivity can be increased if drainage is improved. Poorly drained upland soils, such as Cisne, Racoon, and Wynoose, are so wet that fieldwork is delayed in most years. Even the somewhat poorly drained soils, such as Bluford and Belknap, are wet enough in some years for productivity to be reduced unless some type of drainage system is installed. In the more rolling areas of Ava, Bluford, Grantsburg, and Zanesville soils, hillside seepage can occur. The seeps are normally small. They can hinder fieldwork but do not significantly affect total production. In areas of poorly drained soils on bottom land, both artificial drainage and protection from flooding are needed.

The design of surface and subsurface drainage systems varies with the kind of soil. Tile drains alone are inadequate in most soils. A combination of surface ditches and tile is needed in some areas and open ditches in other areas. Water moves so slowly through some soils that tile lines should be spaced relatively close together. In most soils drained by tile, results are satisfactory if the spacing is 50 to 70 feet. Planting row crops on ridges is becoming an increasingly popular practice on both clayey and silty soils on bottom land. Ridging helps to remove water from the seedbed, improves plant emergence, and helps the plants to survive shallow flooding or ponding. Ridging poorly drained soils promotes early warming and drying of the seedbed. Land leveling and a good surface drainage system that provides outlets for individual ridges help to make ridging more effective.

Surface drainage systems, such as ditching and land leveling, commonly help to drain excess water from the slowly permeable and very slowly permeable soils in the county. Special care is needed to ensure that the ditches are protected against silt deposition and bank erosion.

Information about the drainage system that is suitable for each kind of soil is contained in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Droughtiness limits the productivity of some of the soils used for crops and pasture in the county. Ava, Grantsburg, and other soils having layers that cannot be easily penetrated by plant roots dry out quickly. Moisture stress is soon evident under hot, dry conditions. Measures that improve tilth and reduce the runoff rate and the evaporation rate on the surface help to overcome the adverse effects of droughtiness. Conservation tillage increases the infiltration rate and decreases the runoff rate. Crop residue management reduces the evaporation rate, improves tilth, and increases the infiltration rate. Deferring tillage when the soils are wet helps to maintain good tilth.

Soil fertility is naturally low or medium in most upland soils. All upland soils are naturally acid. Reaction varies more in the soils on flood plains. Belknap, Bonnie, and Piopolis soils commonly are extremely acid to strongly acid, but Petrolia, Titus, and Zipp soils commonly are medium acid to mildly alkaline. The surface layer is less acid if it has been limed. On the acid soils applications of agricultural limestone are needed to maintain or raise the pH level.

Except for Titus soils, which have a dark surface layer, most of the soils in the county have a naturally low to moderate supply of nitrogen. Most crops, particularly corn, wheat, and grain sorghum, respond well to applications of nitrogen fertilizer. Adding livestock waste and planting inoculated legumes help to replenish the nitrogen supply.

Except for the finer textured soils on bottom land, such as Zipp and Titus soils, most of the soils in the county have a low supply of potassium. All of the soils have a naturally low supply of phosphorus.

Additions of lime, phosphorus, potassium, or any of the other elements should be based on the results of soil tests. The Cooperative Extension Service can help in

Figure 8.—Zero-tillage in an area used for corn.

determining the kinds and amounts of fertilizer and lime that should be applied after tests are made.

Soil tilth has important effects on the germination of seeds, the amount of water that runs off the surface, and the infiltration rate. Surface soil that is in good tilth is granular and porous. Cropped soils in the uplands commonly have a silt loam surface layer that is light in color, is low in organic matter content, and has weak structure. Usually, the exposed surface puddles during periods of intense rainfall and crusts as the soil dries. Once the crust forms, the rate of water intake decreases and the rate of runoff increases. Including grasses and legumes in the cropping sequence, regularly returning crop resi-

due to the soil, and adding manure or other organic material improve tilth and help to prevent crusting.

Tilth is a problem in the more clayey soils on bottom land, such as Titus and Zipp soils. These soils often stay wet until late in spring. If plowed when too wet, they tend to be very cloddy. As a result of the cloddiness, preparing a good seedbed is difficult. Chisel plowing these soils in the fall generally results in good tilth in the spring. Leaving crop residue on the surface helps to control soil blowing.

Field crops suited to the soils and climate of the survey area include several that are not commonly grown. Soybeans and corn are the main crops. The acreage planted to grain sorghum is increasing, and sunflowers have been grown in some areas. Wheat is the main small grain crop. Oats, rye, and barley are grown in a few areas, but the acreage planted to these crops has been decreasing for the past several years. Grasses and legumes are grown for both hay and pasture. The well drained and moderately well drained soils are suited to alfalfa, orchardgrass, and bromegrass. The wetter soils are suited to alsike clover, ladino clover, and reed canarygrass. The climate and the soils are suited to the production of orchard fruits, berries, and vegetables. The soils in associations 1 and 2 are better suited to these and other horticultural crops than the soils in associations 3, 4, and 5. The associations are described under the heading "General Soil Map Units."

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*8*). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless

close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Hardwood forest originally covered most of Hamilton County. According to the 1978 Census of Agriculture, 16,886 acres in Hamilton County is wooded (*10*). The acreage of woodland makes up about 6 percent of the total land area.

Most of the trees have been cleared from the soils suitable for cultivated crops. As a result, much of the remaining woodland occurs as areas of soils that are unsuitable for cultivation. In many areas the soils are too steep, too wet, or too stony for cultivated crops. The soils in the wooded areas are well suited or moderately well suited to woodland. The trend in recent years has been the conversion of several hundred acres each year from woodland to cropland, especially in the areas on bottom land. This trend is expected to continue, but at a decreasing rate.

The most common desirable trees on uplands are white oak, red oak, black oak, hickory, black walnut, and yellow-poplar. The main species on bottom land are cottonwood, pin oak, sycamore, and sweetgum.

Trees should be harvested as they mature, and the undesirable trees should be removed. Measures that prevent fires and keep out grazing livestock help to control erosion and promote tree growth. Interplanting of desirable species may be needed. Control of competing vegetation reduces the seedling mortality rate. If trees are planted in bare areas of sloping soils, establishing a grass cover between the rows of seedlings helps to control erosion. Equipment should be used only if the soil is firm enough to support the weight. Runoff should be diverted from haul roads and skid trails on sloping woodland. A surface drainage system improves the woodland in areas of wet soils.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted rooting depth; *c*, clay in the upper part of the soil; *s*, sandy texture; and *f*, high content of coarse fragments in the soil profile. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: r, x, w, t, d, c, s, and f.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is

the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Hamilton County has many areas of scenic and geologic interest. These areas are used for hunting, fishing, camping, hiking, sightseeing, and picnicking. Public lands available for recreation are the Dolan Lake Hamilton County Conservation Area and Lake McLeansboro. One privately owned area that provides opportunities for fishing and camping also is available. Several landowners have developed small recreation areas for private use.

Dolan Lake Hamilton County Conservation Area has been increasingly used in the past several years. Such activities as camping, fishing, and hunting have been particularly popular. The suitability for the development of additional recreation facilities is poor to good in the county. The best suited soils are in soil associations 1 and 2, which are described under the heading "General Soil Map Units" (fig. 9).

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Figure 9.—An area of the Grantsburg-Zanesville association, which is suitable for recreational activities, such as hunting, fishing, hiking, and camping.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Hamilton County has a large and varied population of fish and wildlife. White-tailed deer, squirrel, raccoon, woodpeckers, and various songbirds inhabit the wooded areas. Quail, mourning dove, cottontail rabbit, red fox, coyote, and various songbirds inhabit farmed areas and areas overgrown with grasses, forbs, and shrubs.

The streams, lakes, and ponds are inhabited by largemouth bass, bluegill, crappie, catfish, sunfish, frogs, turtles, muskrat, and several birds and animals that normally live in or near the water. Some of the lakes and ponds also provide resting and feeding areas for migratory ducks and geese in the spring and fall.

In most areas in the county, the wildlife habitat can be improved by providing the food, cover, and water that

the wildlife need to survive. Wildlife plantings along field borders increase the amount of food and cover. Constructed ponds can provide a dependable water supply in many areas, especially those in associations 1 and 2 where natural water supplies often are unavailable during summer and fall.

For the last several years, large tracts of forested land have been cleared for the production of cultivated crops. The removal of trees has greatly reduced the extent of the habitat for woodland wildlife, such as white-tailed deer, raccoons, and squirrels. If this trend continues, the population of some of these species will be reduced unless alternative habitat is provided.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, sorghum, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, bromegrass, timothy, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are broom sedge, goldenrod, foxtail, partridge pea, and Korean lespedeza.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and sumac. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, marsh mallow, cattail, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, mourning dove, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In table 12, ratings are given only for area sanitary landfills. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted and covered daily with a thin layer of soil from a source away from the site.

The landfill must be able to bear heavy vehicular traffic. It involves a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect landfills.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during the wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more

than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates

are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to absorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the suscepti-

bility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that is occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on

the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Illinois Department of Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*9*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning flood plain, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, acid, mesic Typic Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*7*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*9*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ava Series

The Ava series consists of moderately well drained soils on loess-covered till plains. These soils formed in loess and in the underlying silty or loamy material. Permeability is moderately slow in the upper part of the profile and very slow in the lower part. Slopes range from 1 to 18 percent.

Ava soils are similar to Grantsburg and Zanesville soils and commonly are adjacent to Bluford and Hickory soils. Bluford soils are somewhat poorly drained and have more clay in the subsoil than the Ava soils. Also, they are commonly lower on the landscape and on steeper

slopes or narrower ridges. Hickory soils are well drained, are commonly on the steeper slopes, and formed in glacial till. Grantsburg soils have less sand in the lower part of the subsoil than the Ava soils. Zanesville soils have more sand and coarse fragments in the lower part of the subsoil than the Ava soils.

Typical pedon of Ava silt loam, 1 to 5 percent slopes, 898 feet west and 60 feet south of the center of sec. 12, T. 5 S., R. 6 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/6) silt loam; moderate fine subangular blocky structure; friable; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; patchy dark grayish brown (10YR 4/2) organic stains; very strongly acid; clear smooth boundary.

Bt2—14 to 21 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

B/E—21 to 26 inches; yellowish brown (10YR 5/6) silt loam (Bt); pale brown (10YR 6/3) silt coatings and silt pockets (E); moderate medium subangular blocky structure; firm; few distinct dark yellowish brown (10YR 4/6) clay films on faces of peds; very strongly acid; gradual irregular boundary.

B't—26 to 40 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; firm; common distinct brown (7.5YR 4/4) clay films on faces of peds; common distinct light gray (10YR 7/1) silt coatings on faces of peds; very strongly acid; clear smooth boundary.

2Btx—40 to 48 inches; yellowish brown (10YR 5/6) silty clay loam; moderate very coarse prismatic structure parting to moderate coarse subangular blocky; firm; brittle; common distinct brown (7.5YR 4/4) clay films on faces of peds; silt streaks between some prisms; few fine rounded nodules (iron and manganese oxides); few small pebbles; very strongly acid; gradual wavy boundary.

2Bx—48 to 60 inches; brownish yellow (10YR 6/6) silt loam; weak very coarse prismatic structure; firm; brittle; few faint strong brown (7.5YR 5/6) clay films on faces of peds; some silt streaks between some prisms; few small pebbles; very strongly acid.

The solum ranges from 50 to more than 60 inches in thickness. It generally is strongly acid to extremely acid, but in some areas liming has altered the reaction of the surface layer.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3 in all areas except for severely eroded ones. Most areas that have not been plowed have an E horizon. This horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The Bt horizon is silt loam or silty clay loam. It has hue of 10YR or 7.5YR and value and chroma of 4 to 6. The depth to the Bx horizon ranges from 24 to 42 inches in all areas except for some severely eroded ones. The Bx and 2Bx horizons are similar in color and texture to the Bt horizon. The 2Bx horizon, however, contains more sand and pebbles. It is silt loam or loam. Some pedons have gray mottles in the lower part of the solum.

Banlic Series

The Banlic series consists of somewhat poorly drained, slowly permeable soils on low terraces and alluvial fans. These soils formed in silty alluvial deposits and are generally a little higher on the landscape than the surrounding flood plains. Slopes range from 0 to 2 percent.

Banlic soils are adjacent to Belknap, Bonnie, and Creal soils. The somewhat poorly drained Belknap and poorly drained Bonnie soils do not have a Bx horizon and are slightly lower on the landscape than the Banlic soils. Creal soils have more clay in the subsoil than the Banlic soils. They are on upland foot slopes.

Typical pedon of Banlic silt loam, 350 feet north and 75 feet east of the southwest corner of sec. 15, T. 7 S., R. 6 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very pale brown (10YR 7/3) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

E—8 to 16 inches; brown (10YR 5/3) silt loam; many fine distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; neutral; clear smooth boundary.

Bw—16 to 23 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse subangular blocky structure; friable; medium acid; clear smooth boundary.

Bxg1—23 to 32 inches; light gray (10YR 7/1) silt loam; common coarse distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; brittle; very strongly acid; gradual smooth boundary.

Bxg2—32 to 50 inches; light gray (10YR 7/1) silt loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; very firm; brittle; very strongly acid; gradual smooth boundary.

Bxg3—50 to 60 inches; light gray (10YR 7/1) silt loam; common coarse prominent yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; brittle; very strongly acid.

The solum ranges from 45 to more than 60 inches in thickness. It ranges from neutral to very strongly acid. The depth to the Bx horizon ranges from 20 to 32 inches.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon has value of 5 or 6 and chroma of 2 or 3. Some pedons do not have a B horizon above the Bx horizon. The B horizon has value of 5 to 7 and chroma of 2 to 4. The Bx horizon has value of 5 to 7 and chroma of 1 to 4 and is mottled.

Belknap Series

The Belknap series consists of somewhat poorly drained, moderately slowly permeable soils on flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Belknap soils are adjacent to Banlic, Creal, and Racoon soils. All of the adjacent soils are higher on the landscape than the Belknap soils. Banlic soils have a Bx horizon. Creal and Racoon soils have more clay in the subsoil than the Belknap soils.

Typical pedon of Belknap silt loam, 230 feet north and 530 feet west of the center of sec. 24, T. 5 S., R. 5 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

Cg1—10 to 16 inches; grayish brown (10YR 5/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; strongly acid; clear smooth boundary.

Cg2—16 to 26 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few medium rounded nodules (iron and manganese oxides); very strongly acid; gradual smooth boundary.

Cg3—26 to 38 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; common medium rounded nodules (iron and manganese oxides); strongly acid; gradual wavy boundary.

Cg4—38 to 60 inches; light brownish gray (10YR 6/2) silt loam; many coarse distinct yellowish brown (10YR 5/6) mottles; massive; friable; common medium rounded nodules (iron and manganese oxides); strongly acid.

The solum generally is strongly acid or very strongly acid, but in some areas liming has altered the reaction of the surface layer. The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, chroma of 1 to 3 and is mottled. It is very strongly acid to medium acid. In some pedons the part of this horizon below a depth of 40 inches is stratified silt loam, loam, and silty clay loam.

Bluford Series

The Bluford series consists of somewhat poorly drained soils on broad loess-covered till plains. These soils formed in loess and in the underlying silty or loamy material, which contains more sand than the loess. Permeability is moderately slow in the upper part of the profile and slow in the lower part. Slopes range from 0 to 6 percent.

Bluford soils are similar to Creal and Hoyleton soils and are adjacent to Ava, Cisne, Creal, and Hoyleton soils. Creal soils are at the base of slopes, have an E horizon that is thicker than that of the Bluford soils, and contain less clay in the subsoil. Ava soils are moderately well drained and generally are on the narrower ridgetops and steeper side slopes. Cisne and Hoyleton soils have a surface layer that is darker than that of the Bluford soils and do not have a Bx horizon. Cisne soils are poorly drained and are on broad flats or slightly depressional areas. Hoyleton soils are closer to the center of the wider drainage divides than the Bluford soils.

Typical pedon of Bluford silt loam, 2 to 5 percent slopes, in a cultivated field; 1,050 feet west and 500 feet north of the southeast corner of sec. 27, T. 4 S., R. 5 E.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; common roots; slightly acid; abrupt smooth boundary.

E—7 to 14 inches; pale brown (10YR 6/3) silt loam, very pale brown (10YR 7/3) dry; few fine faint yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; common roots; few fine concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt1—14 to 20 inches; pale brown (10YR 6/3) silty clay loam; few fine faint yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; common faint grayish brown (10YR 5/2) clay films and common faint light gray (10YR 7/2) silt coatings on faces of peds; few fine roots; few fine concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bt2—20 to 32 inches; light brownish gray (10YR 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common distinct grayish brown (10YR 5/2) clay films and few faint light gray (10YR 7/2) silt coatings on faces of peds; very strongly acid; gradual wavy boundary.

Bt3—32 to 38 inches; pale brown (10YR 6/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few distinct grayish brown (10YR 5/2) clay films on faces of peds; few fine

concretions (iron and manganese oxides); very strongly acid; gradual wavy boundary.

2Btx—38 to 60 inches; brown (10YR 5/3) silty clay loam; common coarse distinct yellowish brown (10YR 5/6) and common medium distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure; firm; brittle; about 15 percent sand and a few pebbles; few fine black concretions (iron and manganese oxides); strongly acid.

The solum ranges from 50 to more than 60 inches in thickness. It generally is very strongly acid or strongly acid, but in some areas liming has altered the reaction of the surface layer.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Tillage has mixed the A1 and E horizons in some pedons. The E horizon, if it occurs, has value of 5 or 6 and chroma of 2 or 3. The Bt horizon has value of 5 or 6 and chroma of 2 to 4 and has brown, yellowish brown, and grayish mottles. The 2B horizon is similar in color to the Bt horizon, but it generally contains less clay and more sand.

Bonnie Series

The Bonnie series consists of poorly drained, moderately slowly permeable soils on flood plains. These soils formed in silty alluvial deposits. Slopes are less than 2 percent.

Bonnie soils are similar to Petrolia and Piopolis soils and commonly are adjacent to Belknap soils. Petrolia and Piopolis soils are dominantly silty clay loam throughout. Belknap soils do not have gray colors. They are somewhat poorly drained and are on the higher parts of the flood plains.

Typical pedon of Bonnie silt loam, 2,285 feet south and 420 feet east of the northwest corner of sec. 11, T. 4 S., R. 6 E.

Ap—0 to 8 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/1) dry; weak medium granular structure; friable; few medium rounded nodules (iron and manganese oxides); medium acid; clear smooth boundary.

Cg1—8 to 14 inches; light brownish gray (2.5Y 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few medium rounded nodules (iron and manganese oxides); very strongly acid; clear smooth boundary.

Cg2—14 to 25 inches; light gray (10YR 7/1) silt loam; common medium distinct strong brown (7.5YR 5/6) and common medium faint pale brown (10YR 6/3) mottles; massive; friable; common medium rounded soft accumulations (iron and manganese oxides); extremely acid; clear smooth boundary.

Cg3—25 to 32 inches; light gray (10YR 7/1) silt loam; few fine faint strong brown (7.5YR 5/8) mottles; massive; friable; few medium rounded nodules (iron and manganese oxides); extremely acid; clear smooth boundary.

Cg4—32 to 46 inches; light gray (10YR 7/1) silt loam; common medium distinct strong brown (7.5YR 4/6) mottles; massive; friable; few medium rounded nodules (iron and manganese oxides); very strongly acid; gradual wavy boundary.

Cg5—46 to 60 inches; light gray (10YR 7/1) silt loam; many coarse distinct strong brown (7.5YR 5/8) mottles in the lower 6 inches; massive; friable; few coarse rounded black nodules (iron and manganese oxides); very strongly acid.

The control section generally is strongly acid or very strongly acid, but in some pedons it has some subhorizons that are extremely acid. It has a clay content of 18 to 27 percent.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. The C horizon has hue of 10YR, 2.5Y, or 5Y or is neutral in hue. It has value of 5 to 7 and chroma of 0 to 2. It has mottles with high chroma. In some pedons the lower part of the control section and the underlying C horizon have strata of silty clay loam.

Cisne Series

The Cisne series consists of poorly drained, very slowly permeable soils on loess-covered till plains. These soils formed in loess and in the underlying silty material, which contains more sand than the loess. Slopes range from 0 to 2 percent.

Cisne soils are similar to Wynoose soils and are commonly adjacent to Bluford and Hoyleton soils. Wynoose and Bluford soils have a surface layer that is lighter colored than that of the Cisne soils. Bluford and Hoyleton soils are somewhat poorly drained and generally are closer to drainageways than the Cisne soils. Bluford soils have a brittle layer in the lower part of the subsoil. Hoyleton soils are gently sloping.

Typical pedon of Cisne silt loam, in a cultivated field; 1,720 feet west and 78 feet north of the center of sec. 8, T. 4 S., R. 6 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E1—9 to 15 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; common fine distinct yellowish brown (10YR 5/6) mottles; weak thick platy structure; friable; common light gray (10YR 7/2) silt pockets; very strongly acid; clear smooth boundary.

E2—15 to 18 inches; light gray (2.5Y 7/2) silt loam, white (2.5Y 8/2) dry; common medium distinct yellowish brown (10YR 5/6) mottles; weak thick platy structure; friable; common fine nodules (iron and

manganese oxides); white (10YR 8/1) silt pockets; many fine tubular pores; very strongly acid; abrupt smooth boundary.

Btg1—18 to 21 inches; light brownish gray (10YR 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and common medium prominent yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; white (10YR 8/1) silt pockets; common distinct grayish brown (10YR 5/2) clay films on the faces of peds; common fine black concretions (iron and manganese oxides); very strongly acid; gradual wavy boundary.

Btg2—21 to 27 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; many distinct grayish brown (10YR 5/2) clay films on the faces of peds; few medium black nodules (iron and manganese oxides); very strongly acid; gradual wavy boundary.

Btg3—27 to 36 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; many distinct grayish brown (10YR 5/2) clay films on faces of peds; common medium nodules (iron and manganese oxides); very strongly acid; gradual wavy boundary.

2Btg4—36 to 46 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; about 15 percent sand; common distinct grayish brown (10YR 5/2) clay films on vertical faces of peds; common medium nodules (iron and manganese oxides); light gray (10YR 7/2) silt pockets; strongly acid; gradual wavy boundary.

2BCg—46 to 60 inches; grayish brown (2.5Y 5/2) silt loam; many medium distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable; about 15 percent sand; medium acid.

The solum is more than 60 inches thick. The control section is strongly acid or very strongly acid. It has a clay content of 35 to 45 percent.

The Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2. The E horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is mottled.

Creal Series

The Creal series consists of somewhat poorly drained, moderately slowly permeable soils on foot slopes, on terraces, and at the head of some drainageways. These soils formed in loess and silty local alluvium. Slopes range from 0 to 2 percent.

Creal soils are similar to Bluford and Racoon soils and commonly are adjacent to Banlic, Belknap, Bluford, and Racoon soils. Bluford soils have a fine textured Bt horizon. Racoon soils are poorly drained and are lower on the landscape than the Creal soils. Banlic and Belknap soils are in the lower positions on the flood plains. They do not have an argillic horizon.

Typical pedon of Creal silt loam, 2,448 feet east and 513 feet south of the center of sec. 36, T. 3 S., R. 5 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

E1—9 to 18 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; few medium distinct yellowish brown (10YR 5/6) and common medium distinct dark yellowish brown (10YR 4/4) mottles; weak thick platy structure; friable; few distinct dark grayish brown (10YR 4/2) organic stains; few fine nodules (iron and manganese oxides); medium acid; clear smooth boundary.

E2—18 to 27 inches; light brownish gray (10YR 6/2) silt loam, white (10YR 8/2) dry; common medium distinct yellowish brown (10YR 5/6) mottles; weak thick platy structure; friable; common nodules (iron and manganese oxides); common medium vesicular pores; very strongly acid; clear smooth boundary.

Btg1—27 to 32 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium angular and subangular blocky structure; firm; many distinct grayish brown (10YR 5/2) clay films on faces of peds; very strongly acid; clear smooth boundary.

Btg2—32 to 41 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many distinct grayish brown (10YR 5/2) clay films on faces of peds; many medium nodules (iron and manganese oxides); very strongly acid; clear smooth boundary.

Btg3—41 to 55 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; few distinct grayish brown (10YR 5/2) clay films on faces of peds; common medium nodules (iron and manganese oxides); strongly acid; clear smooth boundary.

BCg—55 to 60 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; friable; slightly acid.

The thickness of solum ranges from 45 to more than 60 inches. The control section generally is strongly acid or very strongly acid, but in some areas it has been

affected by liming in the upper part. It has a clay content of 27 to 35 percent.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The E horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 or 3. It is mottled.

Frondorf Series

The Frondorf series consists of moderately deep, well drained, moderately permeable soils on side slopes. These soils formed in a thin layer of loess and in the underlying channery loam residuum. Slopes range from 15 to 35 percent.

Frondorf soils are commonly adjacent to Grantsburg, Wellston, and Zanesville soils. Grantsburg soils are on ridgetops and are higher on the landscape than the Frondorf soils. Also, they have a thicker layer of loess, are less sloping, and have brittle lower horizons. Wellston soils are in positions on the landscape similar to those of the Frondorf soils. They are more than 40 inches deep to bedrock and have a control section that is siltier than that of the Frondorf soils. Zanesville soils are on the less sloping side slopes. They have a layer of loess that is thicker than that of the Frondorf soils and have a brittle layer above the bedrock residuum.

Typical pedon of Frondorf silt loam, 15 to 35 percent slopes, 2,075 feet north and 50 feet east of the southwest corner of sec. 34, T. 6 S., R. 5 E.

A—0 to 3 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine roots; very strongly acid; clear smooth boundary.

E—3 to 6 inches; light yellowish brown (10YR 6/4) silt loam, very pale brown (10YR 7/4) dry; moderate thin platy structure; friable; common fine roots; very strongly acid; clear smooth boundary.

Bt1—6 to 11 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; friable; common distinct strong brown (7.5YR 5/6) clay films on vertical faces of peds and few faint clay films on horizonal faces of peds; common fine roots; strongly acid; gradual smooth boundary.

2Bt2—11 to 16 inches; strong brown (7.5YR 5/6) channery loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; friable; common distinct strong brown (7.5YR 4/6) clay films on faces of peds; common fine roots; about 30 percent channers less than 3 inches in length; very strongly acid; clear smooth boundary.

2Bt3—16 to 24 inches; strong brown (7.5YR 4/6) very channery loam; weak medium subangular blocky structure; friable; few distinct strong brown (7.5YR 4/6) clay films on faces of peds and on rock surfaces; few medium roots; about 50 percent channers, most less than 3 inches in length, some 3 to 10 inches in length; very strongly acid; gradual wavy boundary.

2Cr—24 to 28 inches; strong brown (7.5YR 5/6), fractured, thinly bedded sandstone, siltstone, and shale; massive; few faint strong brown (7.5YR 5/6) clay films on rock surfaces; about 88 percent rock fragments; very strongly acid.

The thickness of the solum and the depth to bedrock range from 20 to 40 inches. The content of clay in the control section ranges from 22 to 35 percent, and the content of fine sand or coarser sand is more than 15 percent. The control section is strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is 1 to 5 inches thick. The E horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is 2 to 6 inches thick. The Bt horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8. It is loam, silty clay loam, silt loam, or the channery or very channery analogs of these textures. The texture varies greatly with increasing depth, depending on the influence of the parent material. Channers make up more than 75 percent of the lower part of the Bt horizon. The Cr horizon varies in color and texture.

Grantsburg Series

The Grantsburg series consists of moderately well drained soils on uplands. These soils formed in loess and in the underlying silty or loamy erosional sediments. Permeability is moderately slow in the upper part of the profile and very slow in the lower part. Slopes range from 2 to 12 percent.

Grantsburg soils are similar to Ava and Zanesville soils and are adjacent to those soils. Ava soils formed in loess and in the underlying Illinoian glacial till or sediments derived from the till. Zanesville soils formed in loess and in the underlying bedrock residuum. They are 40 to 80 inches deep to bedrock and have a loess mantle that is thinner than that of the Grantsburg soils.

Typical pedon of Grantsburg silt loam, 2 to 5 percent slopes, eroded, 700 feet north and 2,520 feet east of the southwest corner of sec. 9., T. 7 S., R. 5 E.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; slightly darker in the upper 1 inch; strong medium granular structure; friable; many fine roots; strongly acid; abrupt smooth boundary.

Bt1—7 to 14 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; very few faint brown (7.5YR 4/4) clay films on faces of peds; common fine roots; very strongly acid; gradual smooth boundary.

Bt2—14 to 22 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky struc-

ture; firm; few faint strong brown (7.5YR 5/6) clay films on faces of peds; few fine roots; few gray silt streaks in the lower 2 inches; very strongly acid; clear smooth boundary.

B/E—22 to 25 inches; yellowish brown (10YR 5/4) silty clay loam (Bt); pale brown (10YR 6/3) clean silt coatings on faces of peds (E); moderate medium subangular blocky structure; firm; many distinct strong brown (7.5YR 5/6) clay films on faces of peds, mostly masked by the silt coatings; very strongly acid; clear wavy boundary.

B't—25 to 38 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many distinct brown (7.5YR 4/4) clay films; many pale brown (10YR 6/3) streaks or mottles; very strongly acid; gradual smooth boundary.

Bx1—38 to 56 inches; yellowish brown (10YR 5/4) silt loam; common medium faint pale brown (10YR 6/3) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; firm; brittle; few faint brown (7.5YR 4/4) clay films on vertical faces of peds; very strongly acid; gradual smooth boundary.

Bx2—56 to 68 inches; yellowish brown (10YR 5/4) silt loam; few medium faint pale brown (10YR 6/3) mottles; weak very coarse prismatic structure with planes of weakness that break into very coarse plates; firm; brittle; strongly acid.

The solum is more than 60 inches thick. It generally is strongly acid or very strongly acid, but in some areas the surface layer and subsurface layer are less acid because they have been limed. The control section has a clay content of 25 to 30 percent.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. Some pedons have an E horizon, which has value of 5 or 6 and chroma of 3 or 4. In eroded areas the surface layer is mixed with subsoil material. The B horizon has hue of 7.5YR or 10YR. The Bt horizon has value of 5 or 6 and chroma of 4 to 6. Above the brittle layer, it is silt loam or silty clay loam. The depth to the Bx horizon generally ranges from 24 to 40 inches, but in some severely eroded areas it is less than 24 inches. The colors of the Bx horizon are similar to those of the Bt horizon.

Hickory Series

The Hickory series consists of well drained, moderately permeable soils on the side slopes of dissected till plains. These soils formed in glacial till that is covered with a thin mantle of loess in places. Slopes range from 15 to 35 percent.

Hickory soils are similar to Wellston soils and commonly are adjacent to Ava soils. Wellston soils are shallower to bedrock than the Hickory soils. Ava soils have a loess mantle that is thicker than that of the Hickory soils. Also, they are higher on the landscape and have brittle layers in the lower part of the subsoil.

Typical pedon of Hickory loam, 15 to 20 percent slopes, eroded, about 1,527 feet south and 594 feet west of the northeast corner of sec. 18, T. 6 S., R. 5 E.

Ap—0 to 3 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; strongly acid; abrupt smooth boundary.

E—3 to 6 inches; yellowish brown (10YR 5/4) loam, very pale brown (10YR 7/4) dry; common fine distinct strong brown (7.5YR 5/6) mottles; weak thin platy structure; friable; common distinct dark brown (10YR 4/3) soft organic accumulations; very strongly acid; clear smooth boundary.

BE—6 to 11 inches; strong brown (7.5YR 5/6) loam; moderate fine subangular blocky structure; friable; few faint brown (7.5YR 5/4) clay films on faces of peds; few distinct black streaks of organic material derived from dead roots; very strongly acid; clear smooth boundary.

Bt1—11 to 16 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; common distinct brown (7.5YR 5/4) clay films on faces of peds; black streaks of organic material derived from dead roots; very strongly acid; clear smooth boundary.

Bt2—16 to 31 inches; yellowish brown (10YR 5/6) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many distinct brown (7.5YR 4/4) clay films and common medium platelike accumulations (iron and manganese oxides) on faces of peds; various other colors derived from decomposed stones; very strongly acid; clear smooth boundary.

Bt3—31 to 47 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct strong brown (7.5YR 5/6) and few medium distinct light gray (10YR 7/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few distinct brown (7.5YR 4/4) clay films on faces of peds and few fine rounded soft accumulations (iron and manganese oxides); strongly acid; gradual wavy boundary.

BC—47 to 60 inches; yellowish brown (10YR 5/6) loam; common medium distinct light gray (10YR 7/2) mottles; weak coarse subangular blocky structure; firm; few distinct brown (7.5YR 4/4) clay films on vertical faces of peds; neutral.

The solum is more than 60 inches thick. The thickness of the loess above the till ranges from 0 to 20 inches. Till pebbles are on the surface in eroded areas. The argillic horizon is strongly acid or very strongly acid. The content of clay in this horizon ranges from 27 to 35 percent, and the content of fine sand or coarser sand is more than 15 percent.

The A horizon generally is loam, but it is silt loam in some pedons. It has value of 4 or 5 and chroma of 2 or 3. In some pedons it is thin and has value of 3. The E horizon, if it occurs, has value of 5 or 6 and chroma of 3 or 4. The Bt horizon has value of 4 to 6 and chroma of 3 to 6. In some pedons it has reddish to gray mottles in the lower part. The BC horizon is loam or clay loam and has a weak prismatic or blocky structure.

Hoyleton Series

The Hoyleton series consists of somewhat poorly drained, slowly permeable soils on loess-covered till plains. These soils formed in loess and in the underlying silty or loamy material, in which the content of sand is more than 10 percent. Slopes range from 1 to 5 percent.

Hoyleton soils are similar to Bluford soils and commonly are adjacent to Bluford, Cisne, and Creal soils. Bluford soils have an A horizon that is lighter colored than that of the Hoyleton soils. Cisne soils are poorly drained and are in the more nearly level areas. Creal soils are on foot slopes. They have an A horizon that is lighter colored than that of the Hoyleton soils. Also, their surface soil is thicker.

Typical pedon of Hoyleton silt loam, 1 to 5 percent slopes, 1,980 feet west and 400 feet north of the southeast corner of sec. 34. T. 3 S., R. 6 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; few streaks of brown (10YR 5/3) material from the E horizon; slightly acid; abrupt smooth boundary.

E—9 to 12 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak thick platy structure; friable; dark grayish brown organic stains on faces of peds; strongly acid; clear smooth boundary.

Bt1—12 to 16 inches; yellowish brown (10YR 5/4) silt loam; common coarse distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common distinct dark grayish brown (10YR 4/2) clay films in old root channels and on faces of peds; few fine rounded nodules (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bt2—16 to 20 inches; pale brown (10YR 6/3) silty clay loam; many medium prominent red (2.5YR 4/8) mottles; moderate fine subangular blocky structure; firm; common distinct light gray (10YR 7/2) silt coatings on faces of peds; common distinct grayish brown (10YR 5/2) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt3—20 to 31 inches; light brownish gray (10YR 6/2) silty clay loam; many medium prominent dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure parting to moderate fine subangular blocky; firm; many distinct grayish brown (10YR 5/2) clay films on faces of peds; few fine rounded nodules (iron and manganese oxides); very strongly acid; gradual smooth boundary.

Bt4—31 to 47 inches; pale brown (10YR 6/3) silty clay loam; many fine faint light brownish gray (2.5Y 6/2), common medium distinct strong brown (7.5YR 5/6), and common medium distinct dark yellowish brown (10YR 4/6) mottles; weak medium prismatic structure; firm; few faint grayish brown (10YR 5/2) clay films on faces of peds; strongly acid; gradual smooth boundary.

2BC—47 to 60 inches; brown (7.5YR 5/4) and light brownish gray (10YR 6/2) silty clay loam; weak medium prismatic structure; firm; few medium rounded nodules (iron and manganese oxides); about 15 percent fine sand; medium acid.

The solum generally is more than 60 inches thick. The control section generally is very strongly acid or strongly acid, but in some pedons it has subhorizons that are extremely acid. The clay content in the control section averages slightly more than 35 percent.

The Ap horizon has value of 3 and chroma of 1 or 2. The E horizon, if it occurs, has value of 5 or 6 and chroma of 3 or 4. The Bt horizon is silty clay loam or silty clay. It has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It generally has yellowish or reddish mottles. The 2C horizon is similar in color to the Bt horizon. It ranges from medium acid to neutral.

Markland Series

The Markland series consists of moderately well drained, slowly permeable soils on stream terraces. These soils formed in a thin mantle of loess and in the underlying stratified lacustrine sediments. Slopes range from 2 to 5 percent.

Markland soils are commonly adjacent to McGary soils. McGary soils are somewhat poorly drained and are lower on the landscape than the Markland soils.

Typical pedon of Markland silt loam, 2 to 5 percent slopes, eroded, 1,420 feet west and 50 feet north of the center of sec. 14., T. 7 S., R. 7 E.

Ap—0 to 8 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

Bt1—8 to 14 inches; yellowish brown (10YR 5/4) silty clay loam; weak medium subangular blocky structure parting to weak very fine subangular blocky; firm; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—14 to 21 inches; yellowish brown (10YR 5/4) silty clay; moderate medium subangular blocky structure; firm; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few medium rounded

nodules (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt3—21 to 30 inches; about 65 percent yellowish brown (10YR 5/4) and 30 percent pale brown (10YR 6/3) silty clay loam; moderate medium subangular blocky structure; firm; common distinct brown (10YR 4/3) clay films on faces of peds; slightly acid; clear smooth boundary.

Bt4—30 to 42 inches; about 40 percent yellowish brown (10YR 5/6) and 40 percent pale brown (10YR 6/3) silt loam; common fine faint light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; friable; many distinct brown (10YR 4/3) clay films on faces of peds; common medium rounded nodules (calcium carbonate); moderately alkaline; clear smooth boundary.

BC—42 to 50 inches; yellowish brown (10YR 5/4) silt loam; common medium faint pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; friable; common medium rounded nodules (calcium carbonate); moderately alkaline; abrupt smooth boundary.

C—50 to 60 inches; brown (10YR 5/3) silty clay loam; few fine faint gray (N 6/0) and common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; many medium rounded nodules (calcium carbonate); moderately alkaline.

The depth to free carbonates ranges from 24 to 40 inches. The loess mantle is less than 20 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Some pedons have an A horizon. This horizon has value of 3 or 4 and chroma of 2 or 3. It is about 3 inches thick. These same pedons commonly have an E horizon, which has value of 5 or 6 and chroma of 2 to 4. Some pedons have a thin BE horizon above the Bt horizon. The Bt horizon ranges from silty clay to silt loam. The Bt and BC horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 6. The C horizon generally is stratified silt loam to silty clay and has many fine to coarse calcium carbonate nodules. It is mildly alkaline or moderately alkaline.

McGary Series

The McGary series consists of somewhat poorly drained, slowly permeable soils on stream terraces. These soils formed in stratified lacustrine sediments mantled with a thin layer of loess. Slopes range from 0 to 3 percent.

McGary soils commonly are adjacent to Markland soils. Markland soils are moderately well drained and are on narrow ridgetops and short side slopes.

Typical pedon of McGary silt loam, 0 to 3 percent slopes, 500 feet west and 140 feet south of the northeast corner of sec. 15, T. 7 S., R. 7 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

Bt—7 to 14 inches; brown (10YR 5/3) silty clay loam; common medium distinct dark yellowish brown (10YR 4/6) and common medium distinct grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

Btg1—14 to 23 inches; grayish brown (2.5Y 5/2) silty clay; many fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium prismatic structure parting to moderate fine angular blocky; firm; many distinct dark gray (10YR 4/1) clay films on faces of peds; slightly acid; gradual smooth boundary.

Btg2—23 to 35 inches; grayish brown (2.5Y 5/2) silty clay; many medium distinct light olive brown (2.5Y 5/4) mottles; moderate fine angular blocky structure; firm; many distinct dark grayish brown (2.5Y 4/2) and dark gray (5Y 4/1) clay films on faces of peds; neutral; gradual smooth boundary.

Btg3—35 to 45 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium distinct light olive brown (2.5Y 5/4) and many medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate fine angular blocky structure; firm; many distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; neutral; gradual smooth boundary.

C—45 to 60 inches; light olive brown (2.5Y 5/4) silt loam and silty clay loam; many medium distinct yellowish brown (10YR 5/6) and many medium faint gray (5Y 5/1) mottles; moderate coarse subangular blocky structure; firm; mildly alkaline.

The thickness of the solum ranges from 40 to 55 inches. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, chroma of 2 to 4 and is mottled. It is dominantly silty clay or silty clay loam and is commonly stratified in the lower part. The C horizon is stratified with coarser textured material and commonly has calcium carbonate nodules.

Petrolia Series

The Petrolia series consists of poorly drained, moderately slowly permeable soils formed in silty alluvial deposits along some of the major drainageways and in some glacial lakebeds. Slopes are less than 2 percent.

Petrolia soils are similar to Bonnie and Piopolis soils and commonly are adjacent to Piopolis and Zipp soils. Bonnie and Piopolis soils are more acid than the Petrolia soils. Also, Bonnie soils contain less clay. Zipp soils contain more clay throughout than the Petrolia soils and are commonly on wider flood plains.

Typical pedon of Petrolia silty clay loam, in a cultivated field; 2,640 feet north and 84 feet east of the southwest corner of sec. 16, T. 6 S., R. 7 E.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silty clay loam, light gray (10YR 7/2) dry; few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium granular structure; friable; slightly acid; clear smooth boundary.

Cg1—8 to 13 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; common faint rounded grayish brown (10YR 5/2) soft accumulations; few distinct light gray (10YR 7/2) silt streaks; common fine rounded nodules (iron and manganese oxides); slightly acid; clear smooth boundary.

Cg2—13 to 26 inches; light brownish gray (2.5Y 6/2) silty clay loam; many coarse prominent strong brown (7.5YR 5/6) and few medium distinct pale brown (10YR 6/3) mottles; massive; firm; common fine rounded nodules (iron and manganese oxides); slightly acid; gradual wavy boundary.

Cg3—26 to 60 inches; gray (5Y 5/1) silty clay loam; common medium prominent strong brown (7.5YR 5/6) mottles; massive; firm; few faint gray (10YR 5/1) clay films along fragments; common fine rounded nodules (iron and manganese oxides); slightly acid.

The 10- to 40-inch control section is slightly acid or neutral, but in some pedons individual subhorizons range to strongly acid. The clay content of the control section ranges from 27 to 35 percent.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or less. The C horizon has hue of 10YR to 5Y, value of 5 or 6, chroma of 2 or less and is mottled. It is dominantly silty clay loam, but in some pedons it has strata of silt loam or silty clay. Some pedons are mildly alkaline below a depth of 60 inches.

Piopolis Series

The Piopolis series consists of poorly drained, slowly permeable soils formed in silty alluvial deposits. These soils are on broad flood plains and on the edge of some glacial lakebeds. Slopes are less than 2 percent.

Piopolis soils are similar to Bonnie and Petrolia soils and commonly are adjacent to Bonnie and Zipp soils. Bonnie soils contain less clay than the Piopolis soils. Petrolia soils are less acid than the Piopolis soils. Zipp soils contain more clay and are less acid than the Piopolis soils. They commonly are on the wider flood plains.

Typical pedon of Piopolis silty clay loam, 1,340 feet south and 1,300 feet west of center of sec. 26, T. 3 S., R. 6 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silty clay loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

Cg1—7 to 14 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct strong brown (7.5YR 5/6) and common medium faint gray (10YR 6/1) mottles; weak coarse subangular blocky structure; firm; strongly acid; gradual smooth boundary.

Cg2—14 to 23 inches; gray (10YR 6/1) silty clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine rounded nodules (iron and manganese oxides); strongly acid; gradual smooth boundary.

Cg3—23 to 37 inches; gray (10YR 6/1) silty clay loam; many medium prominent strong brown (7.5YR 5/6) and common medium prominent yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; firm; common medium rounded soft accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Cg4—37 to 60 inches; gray (10YR 6/1) silty clay loam; few coarse prominent strong brown (7.5YR 5/6) mottles; massive; firm; strongly acid.

The 10- to 40-inch control section is strongly acid or very strongly acid. It has a clay content of 27 to 35 percent.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or less. The C horizon is dominantly silty clay loam, but in some pedons it has strata of silt loam or silty clay below a depth of 40 inches. It has hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or less. Some pedons become less acid with increasing depth and are only slightly acid at a depth of 60 inches.

Racoon Series

The Racoon series consists of poorly drained, slowly permeable soils formed in loess on foot slopes or in depressions on uplands or on terraces. Slopes range from 0 to 2 percent.

Racoon soils are similar to Creal soils and are commonly adjacent to Banlic, Bonnie, Creal, and Wynoose soils. Creal soils are somewhat poorly drained and are on foot slopes. Banlic and Bonnie soils do not have an argillic horizon. They are on flood plains. Wynoose soils have a surface soil that is less than 24 inches thick and have more clay in the Bt horizon than the Racoon soils. Also, they are higher on the landscape.

Typical pedon of Racoon silt loam, about 620 feet south and 1,558 feet east of the northwest corner of sec. 9, T. 4 S., R. 6 E.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; medium acid; abrupt smooth boundary.

E1—10 to 17 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; few medium distinct yellowish brown (10YR 5/4) mottles; weak thick platy structure; friable; dark grayish brown (10YR 4/2) organic stains; common soft accumulations (iron and manganese oxides); extremely acid; clear smooth boundary.

E2—17 to 27 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; common medium faint brown (10YR 5/3) mottles; weak thick platy structure; friable; common vesicles; common soft accumulations (iron and manganese oxides); grayish brown (10YR 5/2) organic stains; extremely acid; clear smooth boundary.

Btg1—27 to 38 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse subangular blocky structure; firm; many faint grayish brown (10YR 5/2) clay films on faces of peds; many soft accumulations (iron and manganese oxides); common light gray (10YR 7/2) silt pockets; extremely acid; gradual wavy boundary.

Btg2—38 to 52 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak coarse subangular blocky structure; firm; common faint grayish brown (10YR 5/2) clay films on faces of peds; many fine soft accumulations (iron and manganese oxides); common light gray (10YR 7/2) silt pockets; very strongly acid; gradual wavy boundary.

Btg3—52 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; firm; few faint grayish brown (10YR 5/2) clay films on the vertical faces of peds; common fine soft accumulations (iron and manganese oxides); pockets of black stains (iron and manganese oxides); strongly acid.

The thickness of the solum ranges from 45 to more than 60 inches. The control section has a clay content of 25 to 35 percent.

The surface soil ranges from 24 to 32 inches in thickness. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon has value of 5 or 6 and chroma of 1 or 2. The Bt horizon has value of 5 or 6 and chroma of 1 or 2 and has mottles with higher chroma. It is strongly acid to extremely acid.

Sharon Series

The Sharon series consists of moderately well drained, moderately permeable soils formed in silty alluvium on narrow bottom land. Slopes are less than 2 percent.

Sharon soils commonly are adjacent to Banlic, Belknap, and Bonnie soils. The adjacent soils are more poorly drained than the Sharon soils and commonly are lower on the landscape, are on wider flood plains, and are farther from streams. Also, Bonnie soils contain more clay.

Typical pedon of Sharon silt loam, about 2,041 feet east and 234 feet north of the southwest corner of sec. 3, T. 7 S., R. 5 E.

Ap—0 to 9 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/4) dry; weak fine granular structure; friable; many medium faint brown (10YR 5/3) organic stains; very strongly acid; abrupt smooth boundary.

A—9 to 18 inches; yellowish brown (10YR 5/4) silt loam; weak medium granular structure; friable; common medium faint brown (10YR 5/3) organic stains; very strongly acid; clear smooth boundary.

C1—18 to 29 inches; brown (10YR 5/3) silt loam; massive; friable; few pale brown (10YR 6/3) silt pockets; many pores; very strongly acid; clear smooth boundary.

C2—29 to 48 inches; brown (10YR 5/3) silt loam; massive; friable; many pores; common faint organic stains along old root channels; very strongly acid; gradual wavy boundary.

C3—48 to 60 inches; mixed brown (10YR 4/3), grayish brown (10YR 5/2), and dark brown (7.5YR 4/4) silt loam; massive; friable; common medium rounded nodules (iron and manganese oxides); very strongly acid.

The control section is strongly acid or very strongly acid. It has a clay content of less than 18 percent.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The C horizon is dominantly silt loam, but in some pedons it has thin layers of loam or sandy loam. It has hue of 10YR, value of 4 to 6, and chroma of 4 to 8. In some pedons it has gray mottles below a depth of 30 inches.

Titus Series

The Titus series consists of poorly drained, slowly permeable soils formed in silty lacustrine sediments in glacial lakebeds. Slopes range from 0 to 2 percent.

Titus soils are adjacent to Zipp soils. Zipp soils have an A horizon that is lighter colored and thinner than that of the Titus soils. Also, they contain more clay throughout the solum and are slightly lower on the landscape.

Typical pedon of Titus silty clay loam, 87 feet south and 720 feet east of the northwest corner of sec. 33, T. 6 S., R. 7 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; firm; slightly acid; abrupt smooth boundary.

AB—10 to 13 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate

medium angular blocky structure; firm; slightly acid; clear smooth boundary.

Bg1—13 to 17 inches; dark gray (10YR 4/1) silty clay loam; common medium faint dark grayish brown (2.5Y 4/2) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine angular blocky structure; firm; many distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common fine rounded nodules (iron and manganese oxides); neutral; clear smooth boundary.

Bg2—17 to 24 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine angular blocky structure; firm; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common fine rounded nodules (iron and manganese oxides); neutral; clear smooth boundary.

Bg3—24 to 31 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine distinct strong brown (7.5YR 5/8) and common medium faint light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; firm; common distinct dark gray (10YR 4/1) organic coatings on faces of peds; common fine rounded nodules (iron and manganese oxides); neutral; gradual wavy boundary.

Bg4—31 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct light olive brown (2.5Y 5/4) and few fine distinct strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure parting to moderate medium subangular blocky; firm; few faint dark gray (10YR 4/1) organic coatings on faces of peds; neutral; gradual wavy boundary.

BCg—40 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; few faint gray (10YR 5/1) organic coatings on the vertical faces of peds; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It ranges from 10 to 16 inches in thickness. The subsoil has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. The Bg horizon is silty clay loam or silty clay. The C horizon is similar to the Bg horizon in color and texture, but some pedons have strata of coarser textured material. Some pedons contain free carbonates below a depth of 60 inches.

Wellston Series

The Wellston series consists of well drained, moderately permeable soils on side slopes in the uplands. These soils formed in loess and in the underlying bedrock residuum. Slopes range from 15 to 35 percent.

Wellston soils are similar to Hickory soils and commonly are adjacent to Frondorf and Zanesville soils. Hickory soils formed in glacial till and are deeper to bedrock than the Wellston soils. Frondorf soils are shallower to bedrock than the Wellston soils and contain more sand and stone fragments within the control section. They are commonly near the head of drainageways. Zanesville soils are moderately well drained and have brittle layers above the bedrock residuum. They are commonly on the upper slopes.

Typical pedon of Wellston silt loam, 15 to 20 percent slopes, 700 feet east and 2,800 feet south of the northwest corner of sec. 6, T. 7 S., R. 5 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; very dark grayish brown (10YR 3/2) organic coatings on faces of peds and in some old root channels; friable; medium acid; clear smooth boundary.

E—3 to 8 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/4) dry; weak medium platy structure parting to weak medium granular; friable; common distinct dark grayish brown (10YR 4/2) organic stains; strongly acid; clear smooth boundary.

BE—8 to 16 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; few faint dark brown (10YR 4/3) organic coatings on faces of peds; very strongly acid; clear smooth boundary.

Bt1—16 to 26 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common distinct brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—26 to 32 inches; strong brown (7.5YR 5/6) silt loam; moderate coarse subangular blocky structure parting to moderate fine and very fine subangular blocky; friable; common distinct brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt3—32 to 40 inches; strong brown (7.5YR 5/6) channery loam; moderate fine and medium subangular blocky structure; friable; common distinct brown (7.5YR 4/4) clay films on faces of peds; about 25 percent sandstone channers; strongly acid; gradual smooth boundary.

2BC—40 to 48 inches; strong brown (7.5YR 5/6) very channery loam; weak coarse subangular blocky structure; friable; few thin brown (7.5YR 4/4) clay films on vertical faces of peds; about 45 percent sandstone channers; very strongly acid; clear smooth boundary.

2R—48 to 50 inches; thinly bedded weathered sandstone and siltstone.

The thickness of the solum ranges from 36 to 50 inches. The depth to bedrock ranges from 40 to 72 inches. The control section is strongly acid or very strongly acid. It has a clay content of 20 to 30 percent.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2. The E horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is dominantly silt loam, but in some pedons it is silty clay loam. The 2B horizon is loam or very channery loam. It contains rock fragments of various sizes. The colors and textures of this horizon are influenced by the parent material weathered from bedrock. Some pedons have a 2C horizon above the bedrock.

Wynoose Series

The Wynoose series consists of poorly drained, very slowly permeable soils on till plains. These soils formed in loess and in the underlying silty material, which contains more sand than the loess. Slopes range from 0 to 2 percent.

Wynoose soils are similar to Cisne soils and commonly are adjacent to Bluford soils. Cisne soils have an A horizon that is darker than that of the Wynoose soils. Bluford soils are somewhat poorly drained and are in the slightly higher landscape positions.

Typical pedon of Wynoose silt loam, in a cultivated field; 775 feet south and 140 feet west of the northeast corner of sec. 16, T. 4 S., R. 5 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak fine granular structure; friable; few fine rounded nodules (iron and manganese oxides); neutral; abrupt smooth boundary.

E1—7 to 13 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; few fine faint light yellowish brown (10YR 6/4) mottles; weak thick platy structure; friable; few fine rounded nodules (iron and manganese oxides); clear smooth boundary.

E2—13 to 17 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; few medium distinct brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to weak medium subangular blocky; friable; common faint light gray (10YR 7/2) silt coatings on faces of peds; few fine rounded nodules (iron and manganese oxides); very strongly acid; clear smooth boundary.

Btg1—17 to 19 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine rounded nodules (iron and manganese oxides); very strongly acid; clear smooth boundary.

Btg2—19 to 28 inches; light brownish gray (10YR 6/2) silty clay; common medium distinct strong brown (7.5YR 5/8) mottles; moderate medium angular and subangular blocky structure; firm; common distinct grayish brown (10YR 5/2) clay films on faces of peds; common fine rounded nodules (iron and manganese oxides); light gray (10YR 7/2) silt pockets in old root channels and crayfish burrows; very strongly acid; gradual wavy boundary.

Btg3—28 to 35 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; few faint grayish brown (10YR 5/2) clay films on faces of peds; light gray (10YR 7/2) silt pockets in old root channels and crayfish burrows; common fine rounded nodules (iron and manganese oxides); very strongly acid; gradual wavy boundary.

Btg4—35 to 46 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few faint grayish brown (10YR 5/2) clay films on faces of peds; common silt coatings on faces of peds, white (10YR 8/2) dry; common fine rounded nodules (iron and manganese oxides); strongly acid; gradual wavy boundary.

2Btg5—46 to 60 inches; light brownish gray (10YR 6/2) silt loam; many coarse distinct strong brown (7.5YR 5/6) and common medium distinct dark brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; friable; slightly brittle; few faint yellowish brown (10YR 5/4) clay films on vertical faces of peds; about 10 percent fine sand; strongly acid.

The solum is more than 60 inches thick. Some pedons do not have a definite break between the B and 2B horizons. The control section is extremely acid or very strongly acid. It has a clay content of 35 to 42 percent.

The Ap horizon has value of 4 or 5 and chroma of 1 or 2. Some wooded areas have an A1 horizon, which is less than 3 inches thick. This horizon may have value of 3. Most pedons have an E horizon, but in some areas this horizon has been mixed with the Ap horizon by deep tillage. The Bt horizon has value of 5 or 6 and chroma of 1 or 2 and has mottles with higher chroma. The 2B horizon is similar in color to the Bt horizon but contains more sand.

Zanesville Series

The Zanesville series consists of moderately well drained soils formed in loess and in the underlying material weathered from sandstone, siltstone, and shale. These soils are on uplands. Permeability is moderate in the upper part of the solum and slow in the lower part. Slopes range from 5 to 18 percent.

Zanesville soils are similar to Ava and Grantsburg soils and commonly are adjacent to Grantsburg and Wellston soils. Ava and Grantsburg soils are deeper to bedrock than the Zanesville soils. They are on ridgetops and the upper side slopes above the Zanesville soils. Wellston

soils commonly are on the steeper slopes. They do not have a brittle layer in the lower part of the subsoil.

Typical pedon of Zanesville silt loam, 10 to 18 percent slopes, severely eroded, about 1,300 feet east and 500 feet north of the center of sec. 8, T. 7 S., R. 5 E.

Ap—0 to 3 inches; yellowish brown (10YR 5/4) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; strongly acid; clear smooth boundary.

Bt1—3 to 8 inches; strong brown (7.5YR 5/6) silty clay loam; moderate very fine subangular blocky structure; friable; common distinct dark brown (7.5YR 4/4) clay films on faces of peds; common fine roots; very strongly acid; clear smooth boundary.

Bt2—8 to 18 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; many distinct dark brown (7.5YR 4/4) clay films on faces of peds; about 5 percent very fine sand; common fine roots; very strongly acid; clear smooth boundary.

Btx1—18 to 34 inches; strong brown (7.5YR 5/6) silt loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; slightly brittle; common distinct dark brown (7.5YR 4/4) clay films on vertical faces of peds; few fine roots; about 10 percent very fine sand; very strongly acid; gradual wavy boundary.

Btx2—34 to 43 inches; strong brown (7.5YR 5/6) silt loam; weak medium prismatic structure; friable; slightly brittle; common distinct dark brown (7.5YR 4/4) clay films on faces of peds; common distinct soft accumulations (iron and manganese oxides) on some faces of peds and in old root channels; about 10 percent very fine sand; very strongly acid; clear smooth boundary.

2Bx—43 to 52 inches; yellowish brown (10YR 5/6) channery silt loam; weak medium prismatic structure; firm; brittle; common distinct brown (7.5YR 5/4) clay films on vertical faces of peds and on surfaces of rock fragments; about 15 percent channers; strongly acid; clear smooth boundary.

2Cr—52 to 70 inches; mixed yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and light olive gray (5Y 6/2) weathered sandstone and shale; massive; firm; some evidence of the downward movement of clay through cracks; neutral; gradual wavy boundary.

2R—70 inches; mixed yellowish brown (10YR 5/6), brown (7.5YR 5/6), and light olive gray (5Y 6/2) shale that has thin layers of sandstone and siltstone; massive; neutral.

The thickness of the solum and the depth to bedrock range from 40 to 80 inches. The depth to a brittle layer is 20 to 30 inches. The subsoil is strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Uneroded pedons have an E horizon. This horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. In eroded areas the subsoil is mixed with the surface layer. The Bt horizon is silt loam or silty clay loam. It has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 8. The content of coarse fragments in the Bx horizon generally ranges from 5 to 50 percent. It increases with increasing depth.

Zipp Series

The Zipp series consists of poorly drained, slowly permeable soils on flood plains and in glacial lakebeds. These soils formed in clayey alluvial and lacustrine sediments. Slopes are less than 2 percent.

Zipp soils commonly are adjacent to Petrolia, Piopolis, and Titus soils. The adjacent soils contain less clay than the Zipp soils. Also, Titus soils are slightly higher on the landscape. They have a dark surface layer. Petrolia and Piopolis soils are on the narrower flood plains and on natural levees at the edge of the wider flood plains.

Typical pedon of Zipp silty clay, 660 feet south and 75 feet east of the northwest corner of sec. 8, T. 4 S., R. 7 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay, light brownish gray (10YR 6/2) dry; moderate fine granular and moderate fine angular blocky structure; very firm; neutral; abrupt smooth boundary.

Bg1—6 to 11 inches; gray (10YR 5/1) silty clay; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; very firm; neutral; gradual smooth boundary.

Bg2—11 to 19 inches; gray (10YR 5/1) silty clay; many coarse distinct yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; very firm; neutral; gradual wavy boundary.

Bg3—19 to 44 inches; gray (10YR 5/1) silty clay; many coarse distinct yellowish brown (10YR 5/6) mottles; moderate coarse blocky structure parting to moderate fine angular blocky; few faint gray (10YR 5/1) clay films on faces of some peds; very firm; neutral; gradual wavy boundary.

Cg—44 to 60 inches; gray (10YR 5/1) silty clay; many coarse distinct yellowish brown (10YR 5/6) mottles; weak coarse angular blocky structure; very firm; mildly alkaline.

The solum has a clay content of 35 to 55 percent. It is medium acid to mildly alkaline.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or less. Where the chroma is 3, this horizon is less than 6 inches thick. It commonly is silty clay, but in some pedons it is very fine sandy loam or silty clay loam. The Bg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1. It is dominantly silty clay, but in some pedons it has subhorizons of silty clay loam. The

Cg horizon is similar to the Bg horizon in color and texture, but in some pedons it has thin layers of coarser textured material. Some pedons have free carbonates within a depth of 60 inches.

Formation of the Soils

This section describes the effects of the factors of soil formation on the soils in Hamilton County. Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the plant and animal life on and in the soil; (3) the topography, or lay of the land; (4) the climate under which the soil material accumulated and has existed since accumulation; and (5) the length of time that the forces of soil formation have acted on the soil material (*6*).

Parent Material

Parent material is the unconsolidated material in which the soils formed. It affects the mineralogical and chemical composition of the soil and, to a large extent, the rate at which the soil-forming processes take place. The soils in Hamilton County formed in loess, alluvium, lacustrine sediments, glacial drift, and material weathered from bedrock.

Loess, or wind deposited material, is the most extensive parent material in the county. It blankets many of the other kinds of parent material. Most areas have two layers of loess. The upper layer is the Peoria Loess, which is gray and yellowish brown silt loam when it is unweathered. The lower layer is the Roxana Silt. It generally is thinner than the layer of Peoria Loess. This silt was weathered before being covered by the Peoria Loess. It commonly contains more sand than the Peoria Loess. It has had a greater influence on the modern soils in areas where it is closer to the surface and the layer of Peoria Loess is thinner. Ava and Bluford are examples of soils that formed in both kinds of loess.

Soils on the flood plains and bottom land in the county formed in alluvium, which is material deposited by water. Many of these soils still receive sediments. Zipp soils formed in clayey alluvial sediments in slack-water areas of former glacial Lake Saline. These soils are on broad flats and in sloughs and old channels. Belknap and Sharon soils formed in silty material on flood plains and alluvial fans.

Lacustrine sediments were deposited by water along the Wabash River and its tributaries following periods of major glaciation. The Wabash River was blocked, forming a slack-water lake (*3*). The deposits from the lake generally range from 20 to 40 feet in thickness. The maximum thickness is more than 100 feet. These sediments are commonly clayey near the surface, but the texture varies, depending on the speed of the water at the time of deposition.

The Illinoian glacier covered most of Hamilton County. The glacial deposits are generally thin and discontinuous. Most have subsequently been covered by deposits of other kinds of parent material. Except for areas where the overlying material has been thinned or removed by erosion, the glacial deposits have had little influence on the soils. Hickory soils formed in the glacial material exposed by erosion.

Some of the soils in Hamilton County formed in material weathered from sandstone, siltstone, and shale. Most of these soils are on steep side slopes. Frondorf soils formed in this material. A layer of loess covers the residuum in some areas. Zaneville soils formed in loess and in the underlying sandstone, siltstone, and shale residuum.

Plant and Animal Life

Living organisms, such as vegetation, animals, bacteria, and fungi have important effects on soil formation. Burrowing animals, for example, help to keep the soil open and porous. Bacteria and fungi aid in the decomposition of plant and animal remains. Vegetation strongly influences the content of organic matter, the color of the surface layer, and the level of fertility in the soils. Most of the soils in Hamilton County formed under forest vegetation and have a light colored surface layer. Ava and Grantsburg are examples. Titus, Hoyleton, and other soils formed under grasses. Their surface layer is darker and contains more organic matter than that of the soils that formed under trees.

Topography

Many differences among soils in the county are caused by topography. Slope affects drainage, runoff, erosion, and deposition. Slopes differ in gradient, length, shape, and exposure. Some or all of these slope characteristics are responsible for the differences among soils that formed in similar kinds of parent material, such as Ava, Bluford, and Wynoose soils. Soils that formed in different kinds of parent material but are in similar landscape positions commonly have similar natural drainage

characteristics. Examples are the well drained Wellston and Hickory soils.

As the slope gradient increases, the runoff rate and the susceptibility to erosion increase, especially if the soils are cultivated. Erosion constantly changes the characteristics of soils, as is indicated by the differences between the severely eroded and uneroded Hickory soils.

A greater amount of clay accumulates in the subsoil of nearly level soils on uplands than in the subsoil of other upland soils. The nearly level soils transmit more water than the other soils and are wetter. The nearly level, poorly drained Wynoose soils have a high content of clay in the subsoil because of this soil-forming process.

Climate

Climate affects the kinds of plants on and in the soil and helps to determine the type or rate of weathering. The humid, temperate climate of Hamilton County has favored the rapid weathering of soil material, the formation of clay, and the downward movement material from the surface layer to the subsoil. Most upland soils in the county have more clay in the subsoil than in the surface layer. More detailed information about the climate is available under the heading "General Nature of the County."

Time

A long period is needed for the formation of mature soils. Changes take place slowly in most kinds of parent material. The age of soils is determined by the degree of profile development. Soils with little or no development are considered immature. Soils having well expressed horizons are considered mature, even if the parent material in which they formed is the same age as that of the parent material in which an immature soil formed. The Sharon and Belknap soils on bottom land are examples of immature soils. They still accumulate deposits during periods of flooding and have only very weakly expressed horizons. The parent material of Banlic soils is similar to that of the Sharon and Belknap soils. The new sediments are deposited slowly enough, however, for a stronger profile development than is evident in the Sharon and Belknap soils.

References

(1) American Association of State Highway [and Transportation Officials.] 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vols., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Frye, John C., A. B. Leonard, H. B. Willman, and H. D. Glass. 1972. Geology and paleontology of Late Pleistocene Lake Saline, southeastern Illinois. Ill. State Geol. Surv. Circ. 471, 44 pp., illus.

(4) Goodspeed Publishers. 1887. History of Gallatin, Saline, Hamilton, Franklin, and Williamson Counties, Illinois. 961 pp., illus.

(5) Harrelson, Ralph S. 1978. Hamilton County. Ill. Mag. 17: 13-40.

(6) Jenny, Hans. 1941. Factors of soil formation. McGraw-Hill Book Company, Inc., 281 pp., illus.

(7) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(8) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(9) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(10) United States Department of Commerce, Bureau of the Censes. 1978. Census of Agriculture. Vol. 1, Part 13.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns, and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-78 at McLeansboro, Illinois]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	40.3	22.3	31.3	67	-7	71	2.58	1.33	3.67	6	3.9
February---	45.4	26.1	35.8	72	-1	91	2.59	1.29	3.70	5	3.2
March------	54.9	34.2	44.5	79	11	228	4.20	2.12	6.00	7	2.8
April------	68.4	45.7	57.1	87	27	513	4.17	2.63	5.55	8	.3
May--------	77.5	54.2	65.9	92	34	803	4.14	2.11	5.90	8	.0
June-------	86.2	62.7	74.5	99	46	1,035	3.81	1.97	5.41	7	.0
July-------	89.5	66.2	77.9	101	51	1,175	3.63	1.72	5.26	7	.0
August-----	88.2	63.9	76.1	101	49	1,119	3.18	1.33	4.73	6	.0
September--	82.1	56.9	69.6	97	38	888	2.94	1.30	4.34	5	.0
October----	70.5	45.2	57.9	88	26	555	2.44	1.01	3.64	5	.0
November---	55.8	35.5	45.7	79	12	201	3.48	1.63	5.06	6	.6
December---	44.2	27.2	35.7	70	1	87	3.43	1.74	4.88	6	2.2
Yearly:											
Average--	66.9	45.0	56.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	103	-7	---	---	---	---	---	---
Total----	---	---	---	---	---	6,766	40.59	34.28	46.60	76	13.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-78 at McLeansboro, Illinois]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 3	Apr. 12	Apr. 29
2 years in 10 later than--	Mar. 29	Apr. 7	Apr. 23
5 years in 10 later than--	Mar. 19	Mar. 29	Apr. 13
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 29	Oct. 22	Oct. 12
2 years in 10 earlier than--	Nov. 3	Oct. 26	Oct. 16
5 years in 10 earlier than--	Nov. 12	Nov. 2	Oct. 25

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-78 at McLeansboro, Illinois]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	217	198	175
8 years in 10	224	204	182
5 years in 10	237	217	195
2 years in 10	250	229	207
1 year in 10	257	236	214

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2	Cisne silt loam	1,301	0.5
3B	Hoyleton silt loam, 1 to 5 percent slopes	4,337	1.6
8E2	Hickory loam, 15 to 20 percent slopes, eroded	1,374	0.5
8E3	Hickory loam, 15 to 22 percent slopes, severely eroded	471	0.2
8F	Hickory loam, 20 to 35 percent slopes	379	0.1
12	Wynoose silt loam	2,707	1.0
13A	Bluford silt loam, 0 to 2 percent slopes	19,735	7.1
13B	Bluford silt loam, 2 to 5 percent slopes	34,955	12.6
13B2	Bluford silt loam, 3 to 6 percent slopes, eroded	20,507	7.4
14B	Ava silt loam, 1 to 5 percent slopes	9,909	3.6
14B2	Ava silt loam, 2 to 5 percent slopes, eroded	6,740	2.4
14C2	Ava silt loam, 5 to 10 percent slopes, eroded	9,102	3.2
14C3	Ava silt loam, 5 to 10 percent slopes, severely eroded	16,687	5.9
14D3	Ava silt loam, 10 to 18 percent slopes, severely eroded	1,769	0.6
72	Sharon silt loam	3,177	1.1
108	Bonnie silt loam	21,630	7.7
109	Racoon silt loam	13,459	4.8
173A	McGary silt loam, 0 to 3 percent slopes	931	0.3
288	Petrolia silty clay loam	1,833	0.7
301B2	Grantsburg silt loam, 2 to 5 percent slopes, eroded	8,256	3.0
301C2	Grantsburg silt loam, 5 to 12 percent slopes, eroded	5,005	1.8
301C3	Grantsburg silt loam, 5 to 12 percent slopes, severely eroded	4,384	1.6
337	Creal silt loam	2,650	1.0
339E	Wellston silt loam, 15 to 20 percent slopes	4,667	1.7
339F	Wellston silt loam, 20 to 35 percent slopes	620	0.2
340C3	Zanesville silt loam, 5 to 10 percent slopes, severely eroded	1,440	0.5
340D2	Zanesville silt loam, 10 to 18 percent slopes, eroded	2,864	1.0
340D3	Zanesville silt loam, 10 to 18 percent slopes, severely eroded	9,787	3.5
382	Belknap silt loam	35,708	12.8
404	Titus silty clay loam	1,024	0.4
420	Piopolis silty clay loam	5,634	2.0
467B2	Markland silt loam, 2 to 5 percent slopes, eroded	310	0.1
524	Zipp silty clay	12,597	4.5
524+	Zipp very fine sandy loam, overwash	490	0.2
786F	Frondorf silt loam, 15 to 35 percent slopes	2,988	1.1
787	Banlic silt loam	3,844	1.4
801E	Orthents, silty, moderately steep	979	0.4
929D3	Ava-Hickory complex, 10 to 18 percent slopes, severely eroded	3,225	1.2
	Water	925	0.3
	Total	278,400	100.0

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
2	Cisne silt loam (where drained)
3B	Hoyleton silt loam, 1 to 5 percent slopes
13A	Bluford silt loam, 0 to 2 percent slopes (where drained)
13B	Bluford silt loam, 2 to 5 percent slopes (where drained)
13B2	Bluford silt loam, 3 to 6 percent slopes, eroded (where drained)
14B	Ava silt loam, 1 to 5 percent slopes
14B2	Ava silt loam, 2 to 5 percent slopes, eroded
72	Sharon silt loam*
108	Bonnie silt loam (where drained)*
109	Racoon silt loam (where drained)
173A	McGary silt loam, 0 to 3 percent slopes (where drained)
288	Petrolia silty clay loam (where drained)
301B2	Grantsburg silt loam, 2 to 5 percent slopes, eroded
337	Creal silt loam (where drained)
382	Belknap silt loam (where drained)
404	Titus silty clay loam (where drained)
420	Piopolis silty clay loam (where drained)
467B2	Markland silt loam, 2 to 5 percent slopes, eroded
524	Zipp silty clay (where drained)
524+	Zipp very fine sandy loam, overwash (where drained)
787	Banlic silt loam (where drained)

* These soils are frequently flooded, but the flooding occurs during the growing season less often than once in 2 years.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Grass-legume hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*
2----------------------- Cisne	IIIw	115	35	52	4.5	7.5
3B---------------------- Hoyleton	IIe	115	34	52	4.7	7.8
8E2--------------------- Hickory	IVe	67	---	26	2.5	4.2
8E3--------------------- Hickory	VIe	---	---	---	2.3	3.9
8F---------------------- Hickory	VIe	---	---	---	2.4	4.0
12---------------------- Wynoose	IIIw	96	33	46	3.9	6.5
13A--------------------- Bluford	IIw	103	33	49	4.1	6.8
13B--------------------- Bluford	IIe	102	33	49	4.1	6.8
13B2-------------------- Bluford	IIe	99	32	47	3.9	6.5
14B, 14B2--------------- Ava	IIe	97	33	48	4.3	7.2
14C2-------------------- Ava	IIIe	94	32	46	4.1	6.8
14C3-------------------- Ava	IVe	74	25	36	3.3	5.5
14D3-------------------- Ava	IVe	70	---	34	2.7	4.5
72---------------------- Sharon	IIw	99	30	41	3.8	6.3
108--------------------- Bonnie	IIIw	113	37	46	4.0	6.7
109--------------------- Racoon	IIIw	108	35	48	4.1	6.8
173A-------------------- McGary	IIw	100	35	45	2.3	3.8
288--------------------- Petrolia	IIIw	110	38	45	4.2	7.0
301B2------------------- Grantsburg	IIe	89	31	43	3.9	6.5

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Grass-legume hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*
301C2--------------------- Grantsburg	IIIe	86	30	42	3.7	6.2
301C3--------------------- Grantsburg	IVe	72	---	35	3.1	5.2
337----------------------- Creal	IIw	109	35	51	4.3	7.2
339E---------------------- Wellston	IVe	95	---	35	3.5	5.8
339F---------------------- Wellston	VIe	---	---	---	3.0	5.0
340C3--------------------- Zanesville	IVe	60	---	---	3.0	5.0
340D2--------------------- Zanesville	IVe	65	---	---	3.0	5.0
340D3--------------------- Zanesville	VIe	---	---	---	---	4.0
382----------------------- Belknap	IIw	124	39	54	4.6	7.6
404----------------------- Titus	IIIw	125	42	52	4.3	7.2
420----------------------- Piopolis	IIIw	115	39	45	4.0	6.7
467B2--------------------- Markland	IIIe	80	28	36	2.6	4.3
524----------------------- Zipp	IIIw	80	20	---	---	7.3
524+---------------------- Zipp	IIIw	105	37	42	3.4	5.7
786F---------------------- Frondorf	VIe	---	---	---	2.0	3.3
787----------------------- Banlic	IIw	115	37	46	4.2	7.0
801E. Orthents						
929D3--------------------- Ava-Hickory	IVe	---	---	---	2.7	4.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
8E2, 8E3, 8F: Hickory	1r	Moderate	Moderate	Slight	Slight	White oak	85	Eastern white pine, yellow-poplar, sugar maple, white oak, northern red oak, green ash, white ash.
						Northern red oak	85	
						Black oak	---	
						Green ash	---	
						Bitternut hickory	---	
						Yellow-poplar	95	
14C2, 14D3: Ava	2o	Slight	Slight	Slight	Slight	White oak	75	Black walnut, eastern cottonwood, sweetgum, yellow-poplar, white oak, American sycamore.
						Northern red oak	80	
						Yellow-poplar	90	
						Black walnut	---	
108: Bonnie	2w	Slight	Severe	Severe	Severe	Pin oak	90	Eastern cottonwood, red maple, American sycamore, sweetgum, baldcypress, pin oak, swamp white oak.
						Eastern cottonwood	100	
						Sweetgum	---	
						Cherrybark oak	---	
						American sycamore	---	
109: Racoon	3w	Slight	Severe	Moderate	Severe	Pin oak	80	Baldcypress, pin oak, red maple, eastern cottonwood, sweetgum.
						Post oak	80	
						Green ash	---	
						White oak	---	
301B2, 301C2, 301C3: Grantsburg	4d	Slight	Slight	Moderate	Moderate	White oak	60	Eastern white pine, eastern redcedar, red pine, shortleaf pine.
						Southern red oak	60	
						Black oak	60	
						White ash	---	
339E, 339F: Wellston	2r	Moderate	Moderate	Slight	Slight	Northern red oak	71	Eastern white pine, yellow-poplar, white oak, northern red oak, white ash, red pine, green ash, American sycamore.
						Yellow-poplar	90	
						Virginia pine	70	
340D2: Zanesville	3o	Slight	Slight	Slight	Slight	Northern red oak	68	Virginia pine, eastern white pine, shortleaf pine.
						Virginia pine	70	
340D3: Zanesville	4d	Slight	Slight	Moderate	Slight	Northern red oak	60	Virginia pine, shortleaf pine.
						Virginia pine	70	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi- nation symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
524 Zipp	2w	Slight	Severe	Severe	Severe	Pin oak	86	Baldcypress, red maple, sweetgum, green ash, eastern cottonwood.
						White oak	75	
						Sweetgum	90	
786F Frondorf	3r	Moderate	Moderate	Moderate	Slight	Black oak	70	Shortleaf pine, loblolly pine, Virginia pine.
929D3*:								
Ava	2o	Slight	Slight	Slight	Slight	White oak	75	Black walnut, eastern cottonwood, sweetgum, yellow-poplar, white oak, American sycamore.
						Northern red oak	80	
						Yellow-poplar	90	
						Black walnut	---	
Hickory	1o	Slight	Slight	Slight	Slight	White oak	85	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut.
						Northern red oak	85	
						Black oak	---	
						Green ash	---	
						Bitternut hickory	---	
						Yellow-poplar	95	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
2 Cisne	Hedge cotoneaster, redosier dogwood, whitebelle honeysuckle.	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood, Washington hawthorn.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, radiant crabapple.	Eastern white pine, baldcypress, black willow, golden willow, Wisconsin weeping willow.	Pin oak, imperial Carolina poplar.
3B Hoyleton	Hedge cotoneaster	Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush, autumn-olive.	Austrian pine, green ash, osageorange, eastern redcedar, Chinese elm.	Eastern white pine, pin oak, Siberian elm.	---
8E2, 8E3, 8F Hickory	Redosier dogwood, whitebelle honeysuckle.	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet, arrowwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn, Virginia pine.	Norway spruce, Austrian pine, red pine.	Eastern white pine.
12 Wynoose	Hedge cotoneaster, redosier dogwood, whitebelle honeysuckle.	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet, Washington hawthorn.	White fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce, radiant crabapple.	Eastern white pine, baldcypress, black willow, golden willow, Wisconsin weeping willow.	Pin oak, imperial Carolina poplar.
13A, 13B, 13B2 Bluford	Gray dogwood, redosier dogwood, whitebelle honeysuckle.	Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, eastern redcedar, Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine.	Baldcypress, Norway spruce.	Eastern white pine, pin oak.
14B, 14B2, 14C2, 14C3, 14D3 Ava	Hedge cotoneaster	Washington hawthorn, Amur privet, Tatarian honeysuckle, arrowwood, Amur honeysuckle, American cranberrybush, autumn-olive.	Austrian pine, green ash, osageorange, eastern redcedar, Chinese elm.	Eastern white pine, pin oak, Siberian elm.	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
72. Sharon	Gray dogwood, redosier dogwood, whitebelle honeysuckle.	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine, eastern redcedar.	Norway spruce, baldcypress.	Pin oak, eastern white pine.
108. Bonnie	Hedge cotoneaster, redosier dogwood, whitebelle honeysuckle.	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush, Washington hawthorn.	White fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce, radiant crabapple.	Eastern white pine, baldcypress, black willow, golden willow, Wisconsin weeping willow.	Pin oak, imperial Carolina poplar.
109. Racoon	Hedge cotoneaster, redosier dogwood, whitebelle honeysuckle.	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet, Washington hawthorn.	White fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce, radiant crabapple.	Eastern white pine, baldcypress, black willow, golden willow, Wisconsin weeping willow.	Pin oak, imperial Carolina poplar.
173A. McGary	Hedge cotoneaster	Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush, autumn-olive.	Austrian pine, green ash, osageorange, eastern redcedar, Chinese elm.	Eastern white pine, pin oak, Siberian elm.	---
288. Petrolia	Hedge cotoneaster, redosier dogwood, whitebelle honeysuckle.	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle, Washington hawthorn.	White fir, blue spruce, Norway spruce, Austrian pine, northern white-cedar, radiant crabapple.	Eastern white pine, baldcypress, black willow, golden willow, Wisconsin weeping willow.	Pin oak, imperial Carolina poplar.
301B2, 301C2, 301C3. Grantsburg	Hedge cotoneaster	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, autumn-olive.	Osageorange, green ash, Austrian pine, eastern redcedar, Chinese elm.	Pin oak, eastern white pine, Siberian elm.	---
337. Creal	Gray dogwood, redosier dogwood, whitebelle honeysuckle.	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn, eastern redcedar.	Norway spruce, baldcypress.	Eastern white pine, pin oak, imperial Carolina poplar.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
339E, 339F Wellston	Redosier dogwood, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood, arrowwood.	White fir, northern white-cedar, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine, red pine.	Eastern white pine.
340C3, 340D2, 340D3 Zanesville	Hedge cotoneaster	Arrowwood, Amur honeysuckle, American cranberrybush, autumn-olive, Tatarian honeysuckle, Amur privet, Washington hawthorn.	Austrian pine, eastern redcedar, green ash, osageorange, Chinese elm.	Eastern white pine, Siberian elm.	---
382 Belknap	Gray dogwood, redosier dogwood, whitebelle honeysuckle.	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn, eastern redcedar.	Norway spruce, baldcypress.	Pin oak, eastern white pine.
404 Titus	Hedge cotoneaster, redosier dogwood, whitebelle honeysuckle.	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet, Washington hawthorn.	White fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce, radiant crabapple.	Eastern white pine, baldcypress, black willow, golden willow, Wisconsin weeping willow.	Imperial Carolina poplar.
420 Piopolis	Hedge cotoneaster, redosier dogwood, whitebelle honeysuckle.	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet, Washington hawthorn.	White fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce, radiant crabapple.	Eastern white pine, baldcypress, black willow, golden willow, Wisconsin weeping willow.	Pin oak, imperial Carolina poplar.
467B2 Markland	Hedge cotoneaster	Arrowwood, Washington hawthorn, Amur honeysuckle, American cranberrybush, Tatarian honeysuckle, Amur privet.	Austrian pine, green ash, osageorange, eastern redcedar, Chinese elm.	Eastern white pine, pin oak, Siberian elm.	---
524 Zipp	Hedge cotoneaster, redosier dogwood, whitebelle honeysuckle.	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush, Washington hawthorn.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, radiant crabapple.	Eastern white pine, baldcypress, black willow, golden willow, Wisconsin weeping willow.	Pin oak, imperial Carolina poplar.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
524+: Zipp	Gray dogwood, hedge cotoneaster, redosier dogwood, whitebelle honeysuckle.	Amur honeysuckle, silky dogwood, American cranberrybush, Amur privet.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Baldcypress, black willow, golden willow, Wisconsin weeping willow.	Pin oak, imperial Carolina poplar.
786F: Frondorf	Redosier dogwood, whitebelle honeysuckle.	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet, arrowwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine, red pine.	Eastern white pine.
787: Banlic	Gray dogwood, redosier dogwood, whitebelle honeysuckle.	Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn, eastern redcedar.	Baldcypress, Norway spruce.	Pin oak, eastern white pine.
801E. Orthents					
929D3*:					
Ava	Hedge cotoneaster	Washington hawthorn, Amur privet, Tatarian honeysuckle, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange, eastern redcedar, Chinese elm.	Eastern white pine, pin oak, Siberian elm.	---
Hickory	Redosier dogwood, whitebelle honeysuckle.	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet, arrowwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine, red pine.	Eastern white pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
2 Cisne	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
3B Hoyleton	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
8E2, 8E3 Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
8F Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
12 Wynoose	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
13A, 13B, 13B2 Bluford	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
14B, 14B2 Ava	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
14C2, 14C3 Ava	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight	Slight.
14D3 Ava	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
72 Sharon	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
108 Bonnie	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
109 Racoon	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
173A McGary	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
288 Petrolia	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding.
301B2 Grantsburg	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
301C2, 301C3 Grantsburg	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
337------------------- Creal	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
339E------------------ Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
339F------------------ Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
340C3----------------- Zanesville	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
340D2, 340D3---------- Zanesville	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
382------------------- Belknap	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
404------------------- Titus	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
420------------------- Piopolis	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding.
467B2----------------- Markland	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
524------------------- Zipp	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, flooding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
524+------------------ Zipp	Severe: flooding, ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding.
786F------------------ Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
787------------------- Banlic	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
801E. Orthents					
929D3*: Ava-------------------	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
Hickory--------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
2----------------- Cisne	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
3B----------------- Hoyleton	Fair	Good	Good	Good	Fair	Poor	Good	Good	Poor.
8E2, 8E3----------- Hickory	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
8F----------------- Hickory	Very poor	Poor	Good	Good	Very poor	Very poor	Poor	Good	Very poor.
12----------------- Wynoose	Poor	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
13A---------------- Bluford	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
13B, 13B2---------- Bluford	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
14B, 14B2, 14C2, 14C3-------------- Ava	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
14D3--------------- Ava	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
72----------------- Sharon	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
108---------------- Bonnie	Poor	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
109---------------- Racoon	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
173A--------------- McGary	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
288---------------- Petrolia	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
301B2-------------- Grantsburg	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
301C2, 301C3------- Grantsburg	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
337---------------- Creal	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
339E--------------- Wellston	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
339F--------------- Wellston	Very poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
340C3 Zanesville	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
340D2, 340D3 Zanesville	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
382 Belknap	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
404 Titus	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
420 Piopolis	Poor	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
467B2 Markland	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
524 Zipp	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
524+ Zipp	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
786F Frondorf	Very poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor.
787 Banlic	Fair	Good	Good	Good	Fair	Good	Good	Good	Fair.
801E. Orthents									
929D3*:									
Ava	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
Hickory	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2----------------- Cisne	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, frost action.	Severe: wetness.
3B---------------- Hoyleton	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
8E2, 8E3, 8F------ Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
12---------------- Wynoose	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
13A, 13B, 13B2---- Bluford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
14B, 14B2--------- Ava	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
14C2, 14C3-------- Ava	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
14D3-------------- Ava	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
72---------------- Sharon	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
108--------------- Bonnie	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
109--------------- Racoon	Severe: cutbanks cave, ponding.	Severe: ponding,	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
173A-------------- McGary	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
288--------------- Petrolia	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
301B2, 301C2, 301C3----------- Grantsburg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
337-------------- Creal	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
339E, 339F-------- Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
340C3------------ Zanesville	Moderate: depth to rock, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Severe: low strength.	Slight.
340D2, 340D3------ Zanesville	Moderate: slope, wetness, depth to rock.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.
382-------------- Belknap	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
404-------------- Titus	Severe: cutbanks cave, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.	Severe: ponding.
420-------------- Piopolis	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding.
467B2------------ Markland	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
524-------------- Zipp	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.	Severe: ponding, too clayey.
524+------------- Zipp	Severe: ponding.	Severe: ponding, shrink-swell, flooding.	Severe: ponding, shrink-swell, flooding.	Severe: ponding, shrink-swell, flooding.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
786F------------- Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
787-------------- Banlic	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action, flooding.	Moderate: wetness, flooding.
801E. Orthents						

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
929D3*:						
Ava----------------	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Hickory------------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "poor," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Area sanitary landfill	Daily cover for landfill
2 Cisne	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Poor: wetness.
3B Hoyleton	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
8E2, 8E3, 8F Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
12 Wynoose	Severe: ponding, percs slowly.	Slight	Severe: ponding.	Poor: too clayey, ponding.
13A Bluford	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Poor: wetness.
13B, 13B2 Bluford	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Poor: wetness.
14B, 14B2 Ava	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
14C2, 14C3 Ava	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Fair: too clayey, wetness.
14D3 Ava	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
72 Sharon	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
108 Bonnie	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
109 Racoon	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Poor: ponding, too acid.
173A McGary	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
288 Petrolia	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Area sanitary landfill	Daily cover for landfill
301B2: Grantsburg	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Poor: wetness.
301C2, 301C3: Grantsburg	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Poor: wetness.
337: Creal	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Poor: wetness.
339E, 339F: Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
340C3: Zanesville	Severe: percs slowly, wetness.	Severe: slope, wetness.	Moderate: depth to rock, wetness.	Fair: too clayey, area reclaim.
340D2, 340D3: Zanesville	Severe: percs slowly, wetness.	Severe: slope, wetness.	Moderate: depth to rock, slope, wetness.	Fair: slope, too clayey, area reclaim.
382: Belknap	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
404: Titus	Severe: ponding, percs slowly.	Slight	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
420: Piopolis	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
467B2: Markland	Severe: wetness, percs slowly.	Moderate: slope.	Slight	Poor: too clayey, hard to pack.
524: Zipp	Severe: flooding, ponding, percs slowly.	Severe: flooding,	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
524+: Zipp	Severe: ponding, percs slowly, flooding.	Severe: ponding, flooding.	Severe: ponding, flooding.	Poor: too clayey, hard to pack, ponding.
786F: Frondorf	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
787: Banlic	Severe: percs slowly, wetness, flooding.	Severe: flooding.	Severe: wetness, flooding.	Poor: wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Area sanitary landfill	Daily cover for landfill
801E. Orthents				
929D3*:				
Ava	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
Hickory	Moderate: slope, percs slowly.	Severe: slope.	Moderate: slope.	Fair: slope, too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
2-------------------- Cisne	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
3B------------------- Hoyleton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
8E2, 8E3, 8F---------- Hickory	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
12------------------- Wynoose	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
13A, 13B, 13B2-------- Bluford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
14B, 14B2, 14C2, 14C3- Ava	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
14D3----------------- Ava	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
72------------------- Sharon	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
108------------------ Bonnie	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
109------------------ Racoon	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
173A----------------- McGary	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
288------------------ Petrolia	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
301B2, 301C2, 301C3--- Grantsburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
337------------------ Creal	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
339E----------------- Wellston	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
339F----------------- Wellston	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
340C3, 340D2, 340D3--- Zanesville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
382 Belknap	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
404 Titus	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
420 Piopolis	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
467B2 Markland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
524 Zipp	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
524+ Zipp	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
786F Frondorf	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
787 Banlic	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
801E. Orthents				
929D3*:				
Ava	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Hickory	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
2----------------- Cisne	Slight---------	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
3B---------------- Hoyleton	Moderate: slope.	Severe: wetness.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
8E2, 8E3, 8F------ Hickory	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
12---------------- Wynoose	Slight---------	Severe: thin layer, ponding.	Percs slowly, frost action, ponding.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
13A--------------- Bluford	Slight---------	Severe: piping.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
13B, 13B2--------- Bluford	Moderate: slope.	Severe: piping.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
14B, 14B2, 14C2, 14C3------------- Ava	Moderate: seepage, slope.	Severe: piping.	Percs slowly, frost action, slope.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness.	Erodes easily, rooting depth.
14D3-------------- Ava	Severe: slope.	Severe: piping.	Percs slowly, frost action, slope.	Wetness, percs slowly, rooting depth.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
72---------------- Sharon	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
108--------------- Bonnie	Slight---------	Severe: ponding.	Flooding, frost action, ponding.	Ponding, erodes easily, flooding.	Erodes easily, ponding.	Wetness, erodes easily.
109--------------- Racoon	Slight---------	Severe: thin layer, ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
173A-------------- McGary	Slight---------	Severe: wetness.	Percs slowly---	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
288--------------- Petrolia	Slight---------	Severe: ponding.	Ponding, percs slowly, flooding.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Wetness, percs slowly.
301B2, 301C2, 301C3------------ Grantsburg	Moderate: slope.	Severe: piping.	Percs slowly, frost action, slope.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness.	Wetness, erodes easily.
337--------------- Creal	Slight---------	Severe: thin layer, wetness.	Frost action---	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
339E, 339F-------- Wellston	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
340C3------------- Zanesville	Moderate: depth to rock, seepage.	Severe: piping.	Percs slowly, slope.	Percs slowly, wetness, rooting depth.	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth.
340D2, 340D3------ Zanesville	Moderate: depth to rock, seepage.	Severe: piping.	Percs slowly, slope.	Percs slowly, wetness, rooting depth.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
382--------------- Belknap	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
404--------------- Titus	Slight---------	Severe: ponding.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, rooting depth, percs slowly.
420--------------- Piopolis	Slight---------	Severe: ponding.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
467B2------------- Markland	Moderate: slope.	Moderate: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
524--------------- Zipp	Slight---------	Severe: ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
524+-------------- Zipp	Slight---------	Severe: ponding.	Ponding, percs slowly, flooding.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Wetness, percs slowly.
786F-------------- Frondorf	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
787--------------- Banlic	Slight---------	Severe: piping.	Percs slowly, frost action, flooding.	Wetness, percs slowly, erodes easily.	Wetness, percs slowly, erodes easily.	Wetness, percs slowly, erodes easily.
801E. Orthents						
929D3*: Ava---------------	Severe: slope.	Severe: piping.	Percs slowly, frost action, slope.	Wetness, percs slowly, rooting depth.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Hickory----------	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
2----------------- Cisne	0-9	Silt loam--------	CL, CL-ML, ML	A-4	0	100	100	90-100	90-100	25-35	5-10
	9-36	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	90-100	90-100	45-60	20-35
	36-60	Silty clay loam, sandy loam, silt loam.	CL	A-6, A-7	0-5	100	90-100	70-95	50-90	30-50	15-30
3B--------------- Hoyleton	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15
	9-47	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-55	20-30
	47-60	Silt loam, loam, clay loam.	CL, CL-ML	A-6, A-7, A-4	0	100	95-100	90-100	70-95	20-45	5-25
8E2, 8E3, 8F----- Hickory	0-11	Loam-------------	CL	A-6, A-4	0-5	95-100	90-100	90-100	85-95	20-35	8-15
	11-47	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	100	90-100	80-95	75-90	30-50	15-30
	47-60	Clay loam, sandy loam, loam.	CL-ML, CL	A-4, A-6	0-5	85-100	85-95	80-95	60-80	20-40	5-20
12--------------- Wynoose	0-17	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-95	20-35	5-15
	17-46	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-95	35-55	15-30
	46-60	Silty clay loam, silt loam, clay loam.	CL, CL-ML	A-6, A-4	0	100	95-100	90-100	70-90	20-40	5-20
13A, 13B, 13B2--- Bluford	0-7	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	95-100	95-100	90-100	20-35	5-15
	7-14	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	95-100	90-100	20-30	NP-10
	14-38	Silty clay loam, silty clay.	CL	A-7, A-6	0	100	95-100	95-100	90-100	35-50	15-25
	38-60	Silt loam, loam, clay loam.	CL-ML, CL	A-6, A-4	0-5	100	95-100	90-100	70-90	25-40	5-20
14B, 14B2, 14C2, 14C3, 14D3------ Ava	0-9	Silt loam--------	CL	A-6, A-4	0	100	100	95-100	90-100	25-35	8-15
	9-21	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	21-40	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	40-60	Silty clay loam, loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	80-90	20-45	5-20
72--------------- Sharon	0-18	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	95-100	85-95	20-30	2-10
	18-48	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	95-100	85-95	20-30	2-10
	48-60	Silt loam, loam, sandy loam.	ML, CL, SM, SC	A-4	0	100	100	70-95	40-90	15-30	NP-10
108-------------- Bonnie	0-8	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
	8-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
109-------------- Racoon	0-10	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	20-40	8-20
	10-27	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	20-40	5-20
	27-60	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
173A------------- McGary	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-15
	7-45	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-100	45-60	25-35
	45-60	Stratified silty clay loam to clay.	CL, CH	A-6, A-7	0	95-100	95-100	95-100	85-100	35-55	20-35
288-------------- Petrolia	0-7	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-100	30-45	12-20
	7-60	Silty clay loam	ML, CL	A-6, A-7	0	100	95-100	90-100	80-100	35-50	10-25
301B2, 301C2, 301C3----------- Grantsburg	0-7	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	90-100	30-40	7-15
	7-22	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	90-100	30-45	10-20
	22-38	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	100	90-100	35-50	10-25
	38-68	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	90-100	30-45	10-20
337-------------- Creal	0-9	Silt loam--------	ML, CL	A-4, A-6	0	100	100	95-100	85-100	30-40	5-15
	9-27	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-35	4-12
	27-55	Silt loam, silty clay loam.	CL-ML, CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	55-60	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	80-100	30-40	7-15
339E, 339F------- Wellston	0-8	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	8-32	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	32-48	Silt loam, loam, gravelly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
340C3, 340D2, 340D3----------- Zanesville	0-3	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	3-18	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	18-52	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	52-70	Sandy clay loam, clay loam channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-95	40-95	20-85	20-40	2-20
	70	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
382-------------- Belknap	0-13	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	80-100	20-30	2-8
	13-60	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	95-100	90-100	80-100	20-35	NP-12
404-------------- Titus	0-13	Silty clay loam	CH, CL	A-7	0	100	100	95-100	90-100	40-55	20-30
	13-40	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	90-100	40-55	20-30
	40-60	Stratified silty clay loam to sand.	CL, SM-SC, SC, CL-ML	A-6, A-4	0	100	90-100	50-90	45-85	20-40	5-25
420-------------- Piopolis	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	75-95	35-50	15-25
	8-40	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-95	35-50	15-25
	40-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-25

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
467B2------------ Markland	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	8-30	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	19-32
	30-60	Stratified clay to silty clay loam.	CL, CH	A-7	0	100	100	90-100	75-95	40-55	15-25
524-------------- Zipp	0-6	Silty clay-------	CH, CL	A-7	0	100	100	95-100	90-95	40-55	15-30
	6-44	Silty clay-------	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	44-60	Silty clay-------	CL, CH	A-7	0	100	100	90-100	75-95	45-60	25-35
524+------------- Zipp	0-12	Very fine sandy loam.	ML-CL	A-4	0	100	100	75-90	33-55	20-30	4-10
	12-37	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	37-60	Clay-------------	CL, CH	A-7	0	100	100	90-100	75-95	45-60	25-35
786F------------- Frondorf	0-11	Silt loam--------	ML, CL, CL-ML	A-4	0-5	90-100	90-100	85-100	75-100	25-35	5-10
	11-24	Channery silty clay loam, channery silt loam, channery loam.	ML, CL, GM, GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
787-------------- Banlic	0-8	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	80-95	21-29	3-9
	8-23	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	90-100	80-95	22-32	3-10
	23-60	Silt loam, silt	ML, CL-ML, CL	A-4	0	100	95-100	90-100	80-95	22-32	3-10
801E. Orthents											
929D3*:											
Ava-------------	0-6	Silt loam--------	CL	A-6, A-4	0	100	100	95-100	90-100	25-35	8-15
	6-18	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	18-60	Silty clay loam, loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	80-90	20-45	5-20
Hickory---------	0-8	Loam-------------	CL	A-6, A-4	0-5	95-100	90-100	90-100	85-95	20-35	8-15
	8-35	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	100	90-100	80-95	75-90	30-50	15-30
	35-60	Clay loam, sandy loam, loam.	CL-ML, CL	A-4, A-6	0-5	85-100	85-95	80-95	60-80	20-40	5-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
2----------------	0-9	15-27	1.30-1.50	0.06-0.6	0.22-0.24	4.5-7.3	Low-----------	0.37	3	6	1-3
Cisne	9-36	35-45	1.40-1.60	<0.06	0.09-0.15	4.5-6.0	High----------	0.37			
	36-60	25-37	1.50-1.70	<0.06	0.08-0.14	5.1-6.5	Moderate------	0.37			
3B---------------	0-9	20-27	1.30-1.50	0.6-2.0	0.22-0.24	3.6-5.5	Moderate------	0.32	3	6	1-3
Hoyleton	9-47	35-45	1.40-1.65	0.06-0.2	0.13-0.20	3.6-5.5	High----------	0.43			
	47-60	15-33	1.35-1.70	0.06-0.2	0.17-0.22	5.1-6.5	Moderate------	0.43			
8E2, 8E3, 8F-----	0-11	19-25	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	0.37	5	6	1-2
Hickory	11-47	27-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Moderate------	0.37			
	47-60	15-32	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low-----------	0.37			
12---------------	0-17	15-22	1.30-1.50	0.2-0.6	0.18-0.22	3.6-5.5	Moderate------	0.43	3	6	.5-2
Wynoose	17-46	35-42	1.40-1.60	<0.06	0.09-0.13	3.6-5.5	High----------	0.43			
	46-60	25-37	1.50-1.70	0.06-0.2	0.08-0.14	3.6-6.0	Moderate------	0.43			
13A, 13B, 13B2---	0-7	20-27	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.43	3	6	1-3
Bluford	7-14	15-25	1.40-1.60	0.2-0.6	0.18-0.20	4.5-6.0	Low-----------	0.43			
	14-38	35-42	1.45-1.65	0.2-0.6	0.11-0.20	4.5-5.5	Moderate------	0.43			
	38-60	22-35	1.60-1.70	0.06-0.2	0.11-0.16	4.5-6.0	Moderate------	0.43			
14B, 14B2, 14C2, 14C3, 14D3------	0-9	20-27	1.30-1.50	0.6-2.0	0.20-0.23	3.6-7.3	Low-----------	0.43	4	6	.5-2
Ava	9-21	22-33	1.40-1.60	0.6-2.0	0.18-0.21	3.6-5.5	Moderate------	0.43			
	21-40	24-35	1.50-1.70	0.2-0.6	0.18-0.21	3.6-5.5	Moderate------	0.43			
	40-60	20-30	1.65-1.80	<0.06	0.09-0.11	3.6-5.5	Low-----------	0.43			
72---------------	0-18	10-18	1.30-1.50	0.6-2.0	0.22-0.24	4.5-5.5	Low-----------	0.37	5	5	.5-2
Sharon	18-48	10-18	1.30-1.50	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.37			
	48-60	5-18	1.35-1.65	0.6-2.0	0.11-0.22	4.5-5.5	Low-----------	0.37			
108--------------	0-8	18-27	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.3	Low-----------	0.43	5	6	1-3
Bonnie	8-60	18-27	1.40-1.60	0.2-0.6	0.20-0.22	3.6-5.5	Low-----------	0.43			
109--------------	0-10	20-27	1.30-1.50	0.2-0.6	0.22-0.24	5.1-7.3	Moderate------	0.43	3	6	1-2
Racoon	10-27	18-25	1.35-1.50	0.2-0.6	0.20-0.22	5.1-6.0	Moderate------	0.43			
	27-60	27-35	1.35-1.60	0.06-0.2	0.18-0.20	<5.6	High----------	0.43			
173A-------------	0-7	22-27	1.35-1.50	0.6-2.0	0.22-0.24	6.6-7.3	Low-----------	0.43	3	5	1-4
McGary	7-45	35-50	1.60-1.75	<0.2	0.11-0.13	5.6-7.8	High----------	0.32			
	45-60	35-50	1.60-1.75	<0.2	0.14-0.16	7.9-8.4	High----------	0.32			
288--------------	0-7	27-35	1.20-1.40	0.2-0.6	0.21-0.23	5.6-8.4	Moderate------	0.32	5	7	2-3
Petrolia	7-60	27-35	1.35-1.45	0.2-0.6	0.18-0.20	6.1-7.3	Moderate------	0.32			
301B2, 301C2, 301C3-----------	0-7	18-25	1.20-1.40	0.2-0.6	0.20-0.24	3.6-6.5	Low-----------	0.43	4-3	6	.5-1
Grantsburg	7-22	20-30	1.30-1.60	0.2-0.6	0.18-0.20	3.6-5.5	Moderate------	0.43			
	22-38	25-35	1.50-1.70	<0.06	0.06-0.08	3.6-5.5	Moderate------	0.43			
	38-68	20-32	1.65-1.80	<0.06	0.08-0.10	3.6-5.5	Moderate------	0.43			
337--------------	0-9	20-27	1.30-1.50	0.2-0.6	0.22-0.24	5.1-7.3	Low-----------	0.37	5	6	1-3
Creal	9-27	18-25	1.35-1.60	0.2-0.6	0.18-0.20	3.6-7.3	Low-----------	0.37			
	27-55	25-35	1.35-1.60	0.2-0.6	0.18-0.20	4.5-6.5	Moderate------	0.37			
	55-60	20-27	1.40-1.60	0.2-0.6	0.20-0.22	4.5-7.3	Low-----------	0.37			
339E, 339F-------	0-8	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low-----------	0.37	4	6	1-3
Wellston	8-32	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37			
	32-48	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low-----------	0.37			
	48	---	---	---	---	---	--------------	----			

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
340C3, 340D2, 340D3----------- Zanesville	0-3	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-5.5	Low----------	0.43	3	---	1-2
	3-18	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-5.5	Low----------	0.37			
	18-52	18-33	1.50-1.75	0.06-0.6	0.08-0.12	4.5-5.5	Low----------	0.37			
	52-70	20-40	1.50-1.70	0.2-2.0	0.08-0.12	4.5-5.5	Low----------	0.28			
	70	---	---	---	---	---	-------------	----			
382------------- Belknap	0-13	8-18	1.30-1.50	0.2-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	5	5	1-3
	13-60	8-25	1.25-1.50	0.2-2.0	0.20-0.22	4.5-6.0	Low----------	0.37			
404------------- Titus	0-13	35-45	1.30-1.50	0.06-0.2	0.11-0.22	6.1-7.8	High---------	0.32	4	4	5-6
	13-40	35-45	1.30-1.50	0.06-0.2	0.11-0.22	6.1-7.8	High---------	0.32			
	40-60	5-30	1.45-1.75	0.2-0.6	0.10-0.20	6.1-7.8	Moderate-----	0.32			
420------------- Piopolis	0-8	27-35	1.20-1.40	0.06-0.2	0.21-0.23	5.1-6.5	Moderate-----	0.43	4	7	1-3
	8-40	27-35	1.40-1.60	0.06-0.2	0.18-0.20	4.5-5.5	Moderate-----	0.43			
	40-60	25-38	1.50-1.70	0.06-0.2	0.18-0.20	5.6-6.5	Moderate-----	0.43			
467B2----------- Markland	0-8	20-27	1.30-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.43	3	5	1-3
	8-30	40-55	1.55-1.70	0.06-0.2	0.11-0.13	5.1-7.3	High---------	0.32			
	30-60	35-50	1.55-1.70	0.06-0.2	0.09-0.11	7.4-8.4	High---------	0.32			
524------------- Zipp	0-6	40-50	1.40-1.60	0.06-0.2	0.12-0.14	6.1-7.3	High---------	0.28	5	4	1-3
	6-44	40-55	1.45-1.70	0.2-0.6	0.11-0.13	5.6-7.3	High---------	0.28			
	44-60	36-55	1.50-1.70	0.2-0.6	0.08-0.10	6.1-7.8	High---------	0.28			
524+------------ Zipp	0-12	10-18	1.30-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.37	5	5	1-3
	12-37	40-55	1.55-1.70	0.2-0.6	0.11-0.13	6.1-7.3	High---------	0.28			
	37-60	35-50	1.55-1.70	0.2-0.6	0.08-0.10	7.9-8.4	High---------	0.28			
786F------------ Frondorf	0-11	18-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.37	3	---	1-3
	11-24	18-35	1.20-1.45	0.6-2.0	0.08-0.16	4.5-5.5	Low----------	0.17			
	24	---	---	---	---	---	-------------	----			
787------------- Banlic	0-8	10-18	1.30-1.50	0.2-0.6	0.22-0.24	4.5-6.5	Low----------	0.43	3	5	.5-2
	8-23	12-18	1.40-1.60	0.06-0.2	0.20-0.22	4.5-6.0	Low----------	0.43			
	23-60	10-20	1.65-1.80	0.06-0.2	0.11-0.12	4.5-6.0	Low----------	0.43			
801E. Orthents											
929D3*: Ava------------	0-6	20-27	1.30-1.50	0.6-2.0	0.20-0.23	3.6-7.3	Low----------	0.43	4	6	.5-2
	6-18	22-33	1.40-1.60	0.6-2.0	0.18-0.21	3.6-5.5	Moderate-----	0.43			
	18-60	20-30	1.65-1.80	<0.06	0.09-0.11	3.6-5.5	Low----------	0.43			
Hickory---------	0-8	19-25	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.37	5	6	1-2
	8-35	27-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Moderate-----	0.37			
	35-60	15-32	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low----------	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
2----------------- Cisne	D	None---------	---	---	0-2.0	Perched	Feb-Jun	>60	---	High-----	High-----	Moderate.
3B---------------- Hoyleton	C	None---------	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High-----	High-----	High.
8E2, 8E3, 8F------ Hickory	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
12---------------- Wynoose	D	None---------	---	---	+.5-2.0	Apparent	Mar-Jun	>60	---	High-----	High-----	High.
13A, 13B, 13B2---- Bluford	C	None---------	---	---	1.0-3.0	Perched	Mar-Jun	>60	---	High-----	High-----	High.
14B, 14B2, 14C2, 14C3, 14D3------- Ava	C	None---------	---	---	2.0-4.0	Perched	Mar-Jun	>60	---	High-----	Moderate	High.
72---------------- Sharon	B	Frequent----	Brief-----	Mar-May	3.0-6.0	Apparent	Mar-Jun	>60	---	High-----	Low------	High.
108--------------- Bonnie	C/D	Frequent----	Long------	Mar-May	+.5-1.0	Apparent	Mar-Jun	>60	---	High-----	High-----	High.
109--------------- Racoon	C/D	None---------	---	---	+.5-1.0	Apparent	Mar-Jun	>60	---	High-----	High-----	High.
173A-------------- McGary	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	Moderate	High-----	Low.
288--------------- Petrolia	C/D	Occasional	Brief to long.	Mar-Jun	+.5-3.0	Apparent	Apr-Jun	>60	---	High-----	High-----	Low.
301B2, 301C2, 301C3------------- Grantsburg	C	None---------	---	---	1.0-2.0	Perched	Feb-Apr	>60	---	High-----	High-----	High.
337--------------- Creal	C	None---------	---	---	1.0-3.0	Apparent	Feb-May	>60	---	High-----	High-----	High.
339E, 339F-------- Wellston	B	None---------	---	---	>6.0	---	---	>40	Hard	High-----	Moderate	High.
340C3, 340D2, 340D3------------ Zanesville	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	>40	Hard	---	Moderate	High.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
382----------------- Belknap	C	Occasional	Brief to long.	Mar-May	1.0-3.0	Apparent	Mar-Jun	>60	---	High-----	High-----	High.
404----------------- Titus	B/D	Rare---------	---	---	+.5-2.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Low.
420----------------- Piopolis	C/D	Occasional	Long------	Mar-Jun	+.5-3.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Moderate.
467B2--------------- Markland	C	None---------	---	---	3.0-6.0	Perched	Mar-Apr	>60	---	Moderate	High-----	Moderate.
524----------------- Zipp	D	Occasional	Brief-----	Dec-May	+.5-1.0	Apparent	Dec-May	>60	---	Moderate	High-----	Low.
524+---------------- Zipp	D	Occasional	Brief-----	Dec-May	+.5-1.0	Apparent	Dec-May	>60	---	Moderate	High-----	Low.
786F---------------- Frondorf	B	None---------	---	---	>6.0	---	---	20-40	Soft	---	Moderate	High.
787----------------- Banlic	C	Occasional	Brief-----	May-Jun	1.0-3.0	Perched	Jan-Jun	>60	---	High-----	High-----	High.
801E. Orthents												
929D3*:												
Ava-----------------	C	None---------	---	---	2.0-4.0	Perched	Mar-Jun	>60	---	High-----	Moderate	High.
Hickory-------------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

[Dashes indicate that data were not available. MAX means maximum dry density; OPT, optimum moisture; LL, liquid limit; PI, plasticity index; and UN, Unified]

Soil name and location	Sample number	Horizon	Depth	Moisture density		Percentage passing sieve--				LL	PI	Classification	
				MAX	OPT	No. 4	No. 10	No. 40	No. 200			AASHTO	UN
			In	Lb/ft3	Pct					Pct			
Bluford silt loam: 327 feet north and 2,523 feet east of the southwest corner of sec. 36, T. 4 S., R. 6 E.	79IL33-9-1	Bt1-Bt3	11-33	100	23	---	100	99	97	52	28	A-7-6	CH
	79IL33-9-2	Bt4	33-60	110	15	---	100	98	85	31	15	A-6	CL
Bonnie silt loam: 2,285 feet south and 420 feet east of the northwest corner of sec. 11, T. 4 S., R. 6 E.	78IL33-9-1	Cg2-Cg4	14-46	106	18	---	---	100	97	30	10	A-4	CL
Frondorf silt loam: 2,750 feet west and 1,500 feet north of the southeast corner of sec. 13, T. 6 S., R. 5 E.	79IL33-2-1	BA, Bt1	7-14	115	14	95	91	85	66	24	5	A-4	CL-ML
	79IL33-2-2	Bt2, C	14-31	110	17	94	88	79	61	35	13	A-6	CL
Hoyleton silt loam: 2,420 feet west and 75 feet north of the southeast corner of sec. 6, T. 4 S., R. 6 E.	79IL33-5-1	Ap	0-8	98	19	---	100	97	90	31	7	A-4	ML
	79IL33-5-2	Bt1, Bt2	14-26	94	24	---	100	99	98	49	22	A-7-6	CL
	79IL33-5-3	Bt3, 2BC	26-60	106	19	---	100	98	90	41	24	A-7-6	CL
Racoon silt loam: 520 feet east and 230 feet north of the southwest corner of sec. 26, T. 3 S., R. 5 E.	79IL33-4-1	Ap	0-8	103	17	100	99	96	86	29	8	A-4	CL
	79IL33-4-2	E1, E2	8-18	106	17	---	100	97	89	26	7	A-4	CL-ML
	79IL33-4-3	Bt1	26-37	108	18	---	100	98	90	41	24	A-7-6	CL
Sharon silt loam: 2,041 feet east and 234 feet north of the southwest corner of sec. 3, T. 7 S., R. 5 E.	78IL33-14-1	Ap	0-9	102	18	---	---	100	85	30	9	A-4	CL
	78IL33-14-2	A, C1	9-29	107	14	---	---	100	91	27	5	A-4	CL-ML
	78IL33-14-3	C2, C3	29-60	108	15	---	---	100	82	28	7	A-4	CL-ML
Titus silty clay loam: 87 feet south and 720 feet east of the northwest corner of sec. 33, T. 6 S., R. 7 E.	79IL33-11-1	Bg2-Bg4	17-40	100	21	---	100	99	96	47	27	A-7-6	CL
	79IL33-11-2	BCg	40-60	109	17	---	100	99	96	43	23	A-7-6	CL

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

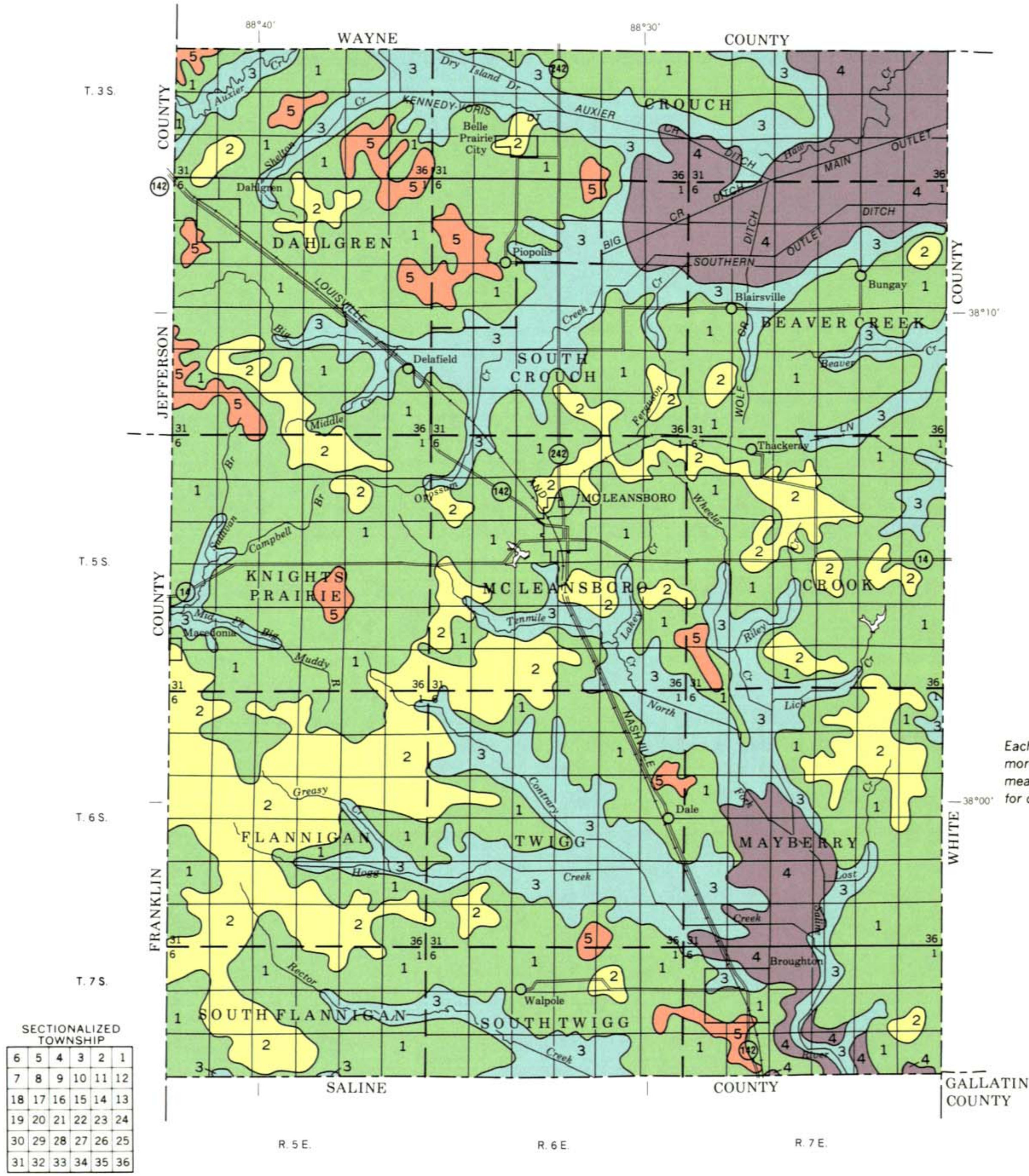
Soil name and location	Sample number	Horizon	Depth	Moisture density		Percentage passing sieve--				LL	PI	Classification	
				MAX	OPT	No. 4	No. 10	No. 40	No. 200			AASHTO	UN
			In	Lb/ft3	Pct					Pct			
Zipp silty clay: 750 feet west and 1,700 feet north of the southeast corner of sec. 8, T. 4 S., R. 7 E.	79IL33-7-1	Bg1-Bg3	9-40	98	22	---	---	100	99	59	36	A-7-6	CH

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Ava	Fine-silty, mixed, mesic Typic Fragiudalfs
Banlic	Coarse-silty, mixed, nonacid, mesic Aeric Haplaquepts
Belknap	Coarse-silty, mixed, acid, mesic Aeric Fluvaquents
Bluford	Fine, montmorillonitic, mesic Aeric Ochraqualfs
Bonnie	Fine-silty, mixed, acid, mesic Typic Fluvaquents
Cisne	Fine, montmorillonitic, mesic Mollic Albaqualfs
Creal	Fine-silty, mixed, mesic Aeric Ochraqualfs
Frondorf	Fine-loamy, mixed, mesic Ultic Hapludalfs
Grantsburg	Fine-silty, mixed, mesic Typic Fragiudalfs
Hickory	Fine-loamy, mixed, mesic Typic Hapludalfs
Hoyleton	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Markland	Fine, mixed, mesic Typic Hapludalfs
McGary	Fine, mixed, mesic Aeric Ochraqualfs
Orthents	Fine-silty, mixed, mesic Udorthents
Petrolia	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Piopolis	Fine-silty, mixed, acid, mesic Typic Fluvaquents
Racoon	Fine-silty, mixed, mesic Typic Ochraqualfs
Sharon	Coarse-silty, mixed, acid, mesic Typic Udifluvents
Titus	Fine, montmorillonitic, mesic Fluvaquentic Haplaquolls
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
Wynoose	Fine, montmorillonitic, mesic Typic Albaqualfs
Zanesville	Fine-silty, mixed, mesic Typic Fragiudalfs
Zipp	Fine, mixed, nonacid, mesic Typic Haplaquepts

☆ U.S. GOVERNMENT PRINTING OFFICE: 1988 - 482-148/20077

NRCS Accessibility Statement



N

LEGEND

1	BLUFORD-AVA association: Nearly level to strongly sloping, somewhat poorly drained and moderately well drained soils formed in loess and in the underlying silty or loamy material; on uplands
2	GRANTSBURG-ZANESVILLE association: Gently sloping to strongly sloping, moderately well drained soils formed in loess and the underlying silty or loamy erosional sediments or in loess and the underlying material weathered from sandstone, siltstone, and shale; on uplands
3	BELKNAP-BONNIE association: Nearly level, somewhat poorly drained and poorly drained soils formed in silty alluvium; on flood plains
4	ZIPP association: Nearly level, poorly drained soils formed in clayey alluvial or lacustrine sediments; on flood plains and in glacial lake-beds
5	BLUFORD-HOYLETON-CISNE association: Nearly level and gently sloping, somewhat poorly drained and poorly drained soils formed in loess and in the underlying silty or loamy material; on uplands

COMPILED 1982

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

US DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ILLINOIS AGRICULTURAL EXPERIMENT STATION

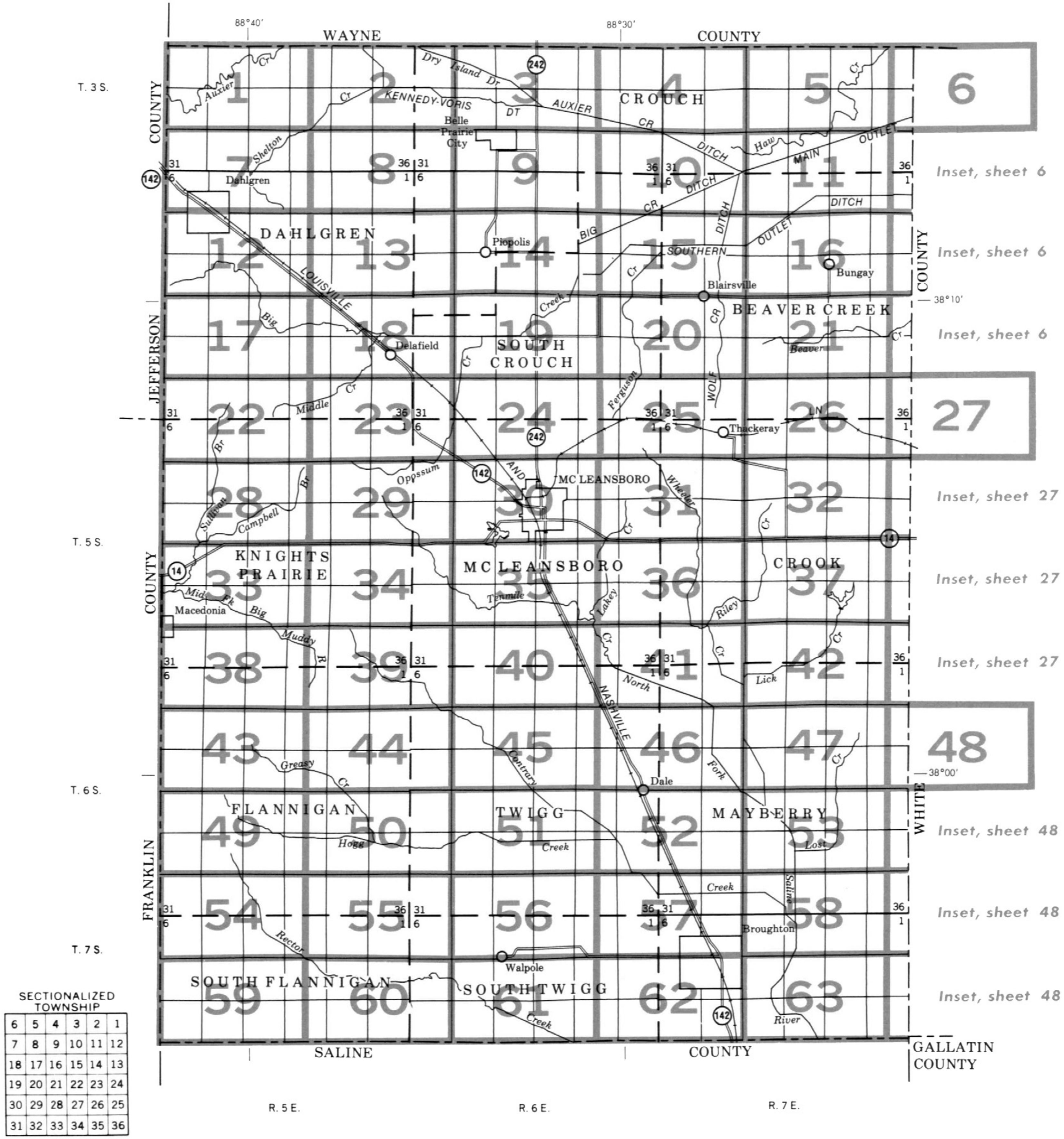
GENERAL SOIL MAP

HAMILTON COUNTY, ILLINOIS

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km



INDEX TO MAP SHEETS

HAMILTON COUNTY, ILLINOIS

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils. A final number of 2 following the slope letter indicates that the soil is eroded and 3 that it is severely eroded.

SYMBOL	NAME
2	Cisne silt loam
3B	Hoyleton silt loam, 1 to 5 percent slopes
8E2	Hickory loam, 15 to 20 percent slopes, eroded
8E3	Hickory loam, 15 to 22 percent slopes, severely eroded
8F	Hickory loam, 20 to 35 percent slopes
12	Wynoose silt loam
13A	Bluford silt loam, 0 to 2 percent slopes
13B	Bluford silt loam, 2 to 5 percent slopes
13B2	Bluford silt loam, 3 to 6 percent slopes, eroded
14B	Ava silt loam, 1 to 5 percent slopes
14B2	Ava silt loam, 2 to 5 percent slopes, eroded
14C2	Ava silt loam, 5 to 10 percent slopes, eroded
14C3	Ava silt loam, 5 to 10 percent slopes, severely eroded
14D3	Ava silt loam, 10 to 18 percent slopes, severely eroded
72	Sharon silt loam
108	Bonnie silt loam
109	Racoon silt loam
173A	McGary silt loam, 0 to 3 percent slopes
288	Petrolia silty clay loam
301B2	Grantsburg silt loam, 2 to 5 percent slopes, eroded
301C2	Grantsburg silt loam, 5 to 12 percent slopes, eroded
301C3	Grantsburg silt loam, 5 to 12 percent slopes, severely eroded
337	Creal silt loam
339E	Wellston silt loam, 15 to 20 percent slopes
339F	Wellston silt loam, 20 to 35 percent slopes
340C3	Zanesville silt loam, 5 to 10 percent slopes, severely eroded
340D2	Zanesville silt loam, 10 to 18 percent slopes, eroded
340D3	Zanesville silt loam, 10 to 18 percent slopes, severely eroded
382	Belknap silt loam
404	Titus silty clay loam
420	Piopolis silty clay loam
467B2	Markland silt loam, 2 to 5 percent slopes, eroded
524	Zipp silty clay
524+	Zipp very fine sandy loam, overwash
786F	Frondorf silt loam, 15 to 35 percent slopes
787	Banlic silt loam
801E	Orthents, silty, moderately steep
929D3	Ava-Hickory complex, 10 to 18 percent slopes, severely eroded

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County or parish
- Field sheet matchline & neatline
- Reservation (national forest or park, state forest or park)

AD HOC BOUNDARY (label)

- Small airport, airfield, park, cemetery — Davis Airstrip

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Other roads

ROAD EMBLEMS & DESIGNATIONS

- State — 52

RAILROAD

DAMS

- Medium or small — water, w

PITS

- Mine or quarry

WATER FEATURES

DRAINAGE

- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w

MISCELLANEOUS WATER FEATURES

- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 8E2, 382

ESCARPMENTS

- Other than bedrock (points down slope)

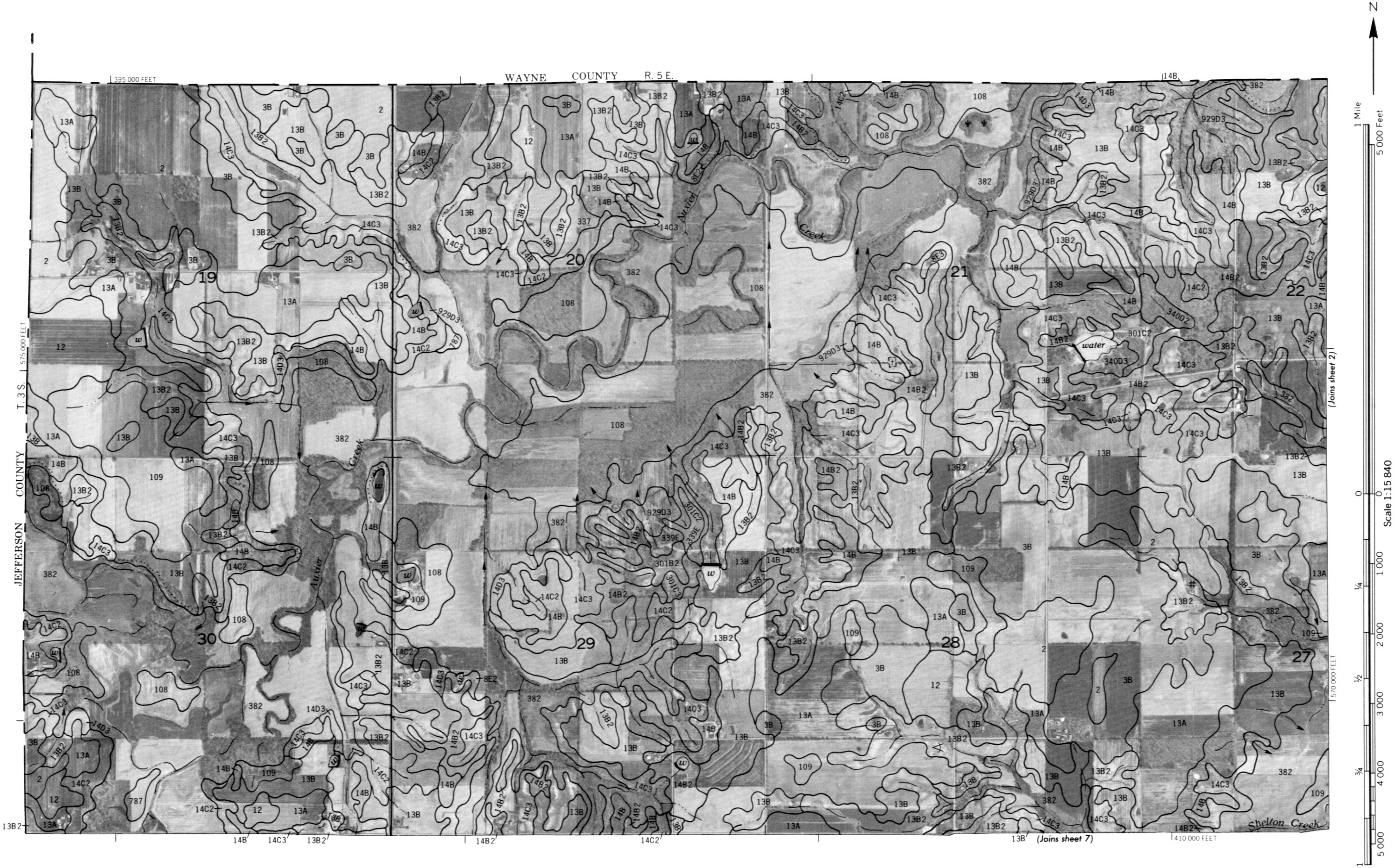
SHORT STEEP SLOPE

SOIL SAMPLE SITE — S

MISCELLANEOUS

- Dumps and other similar non soil areas
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Severely eroded spot
- Oil waste land
- Gumbo, slick or scabby spot (sodic)

HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 1



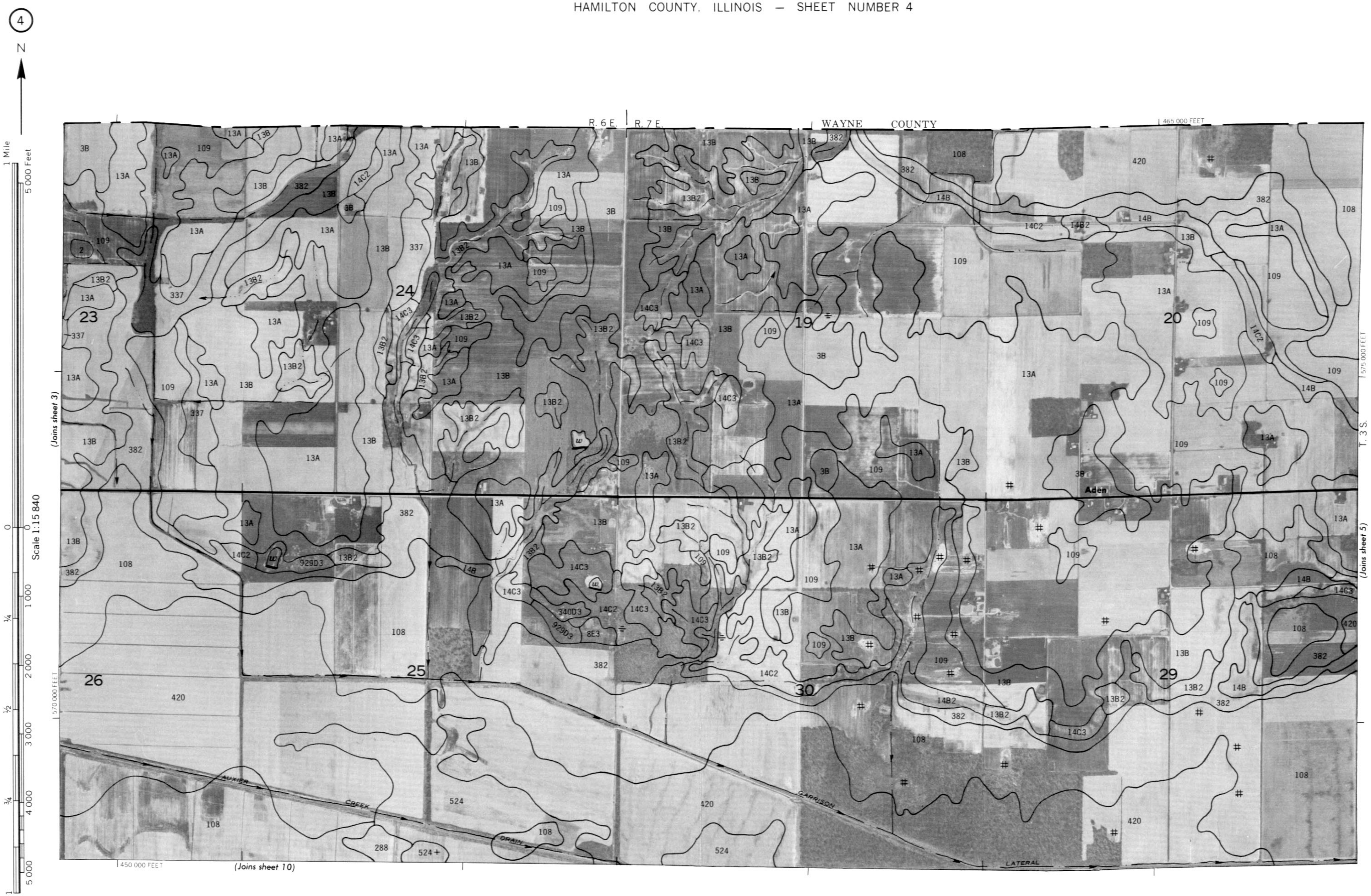
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 2

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

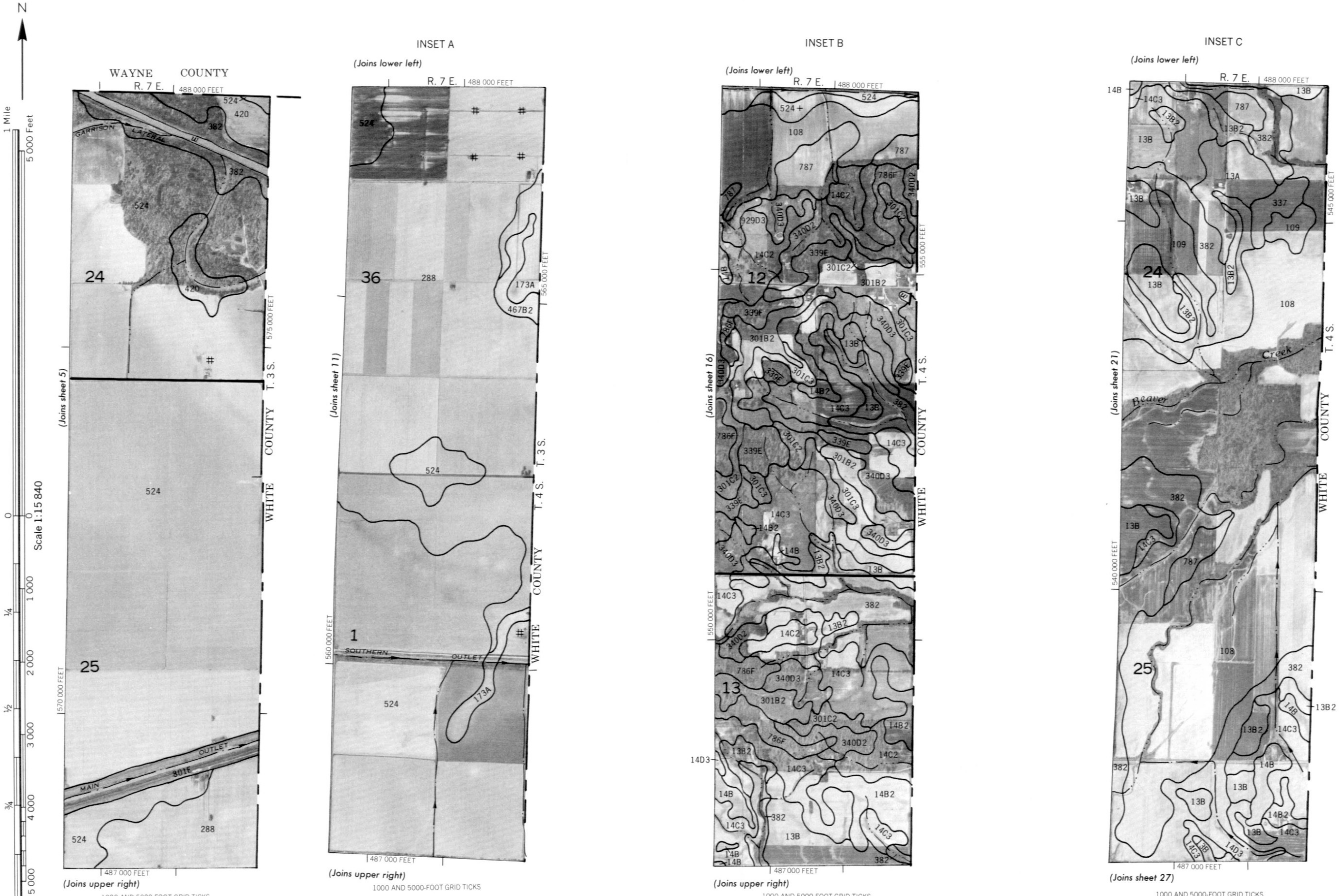
3

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

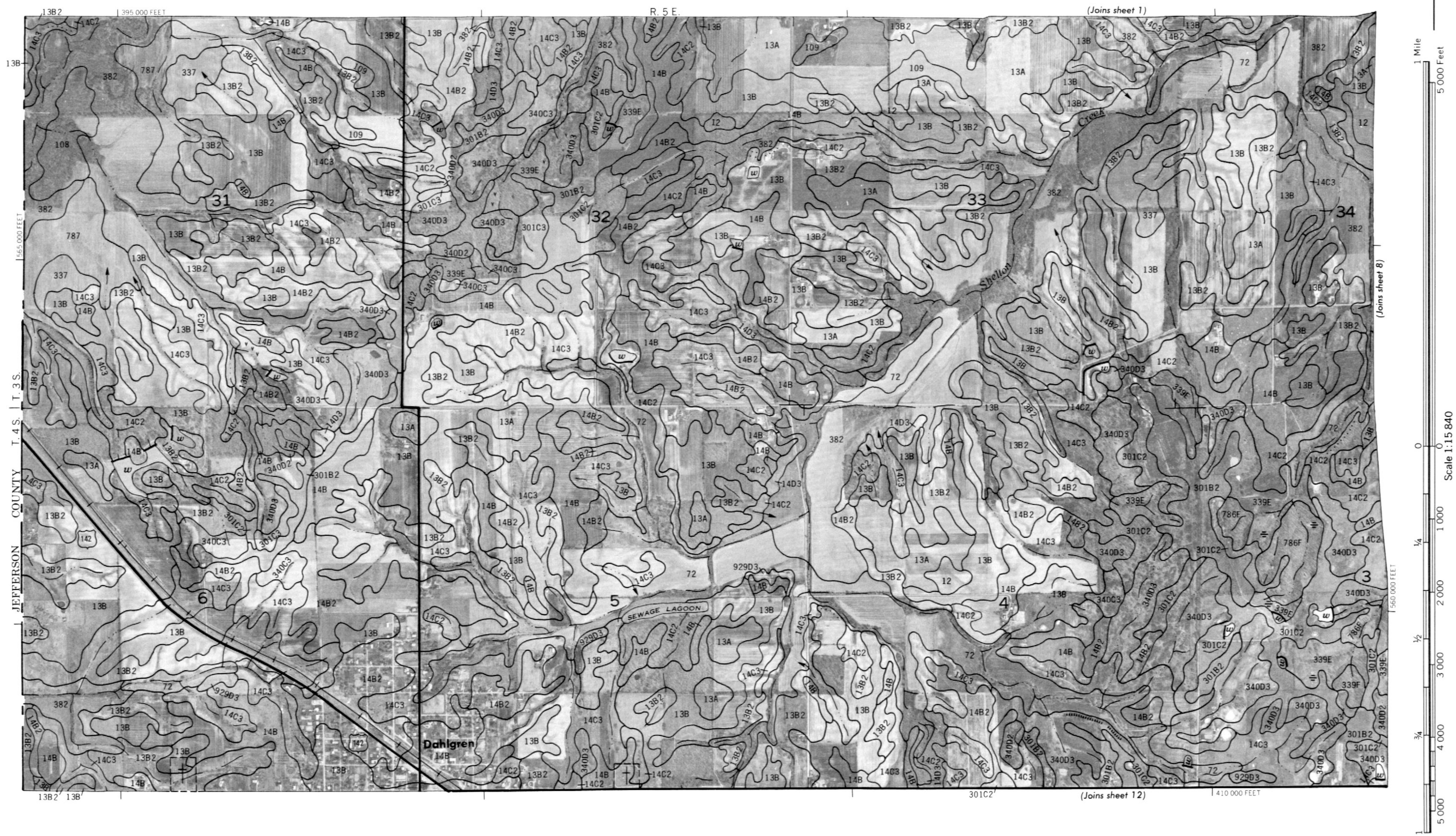


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

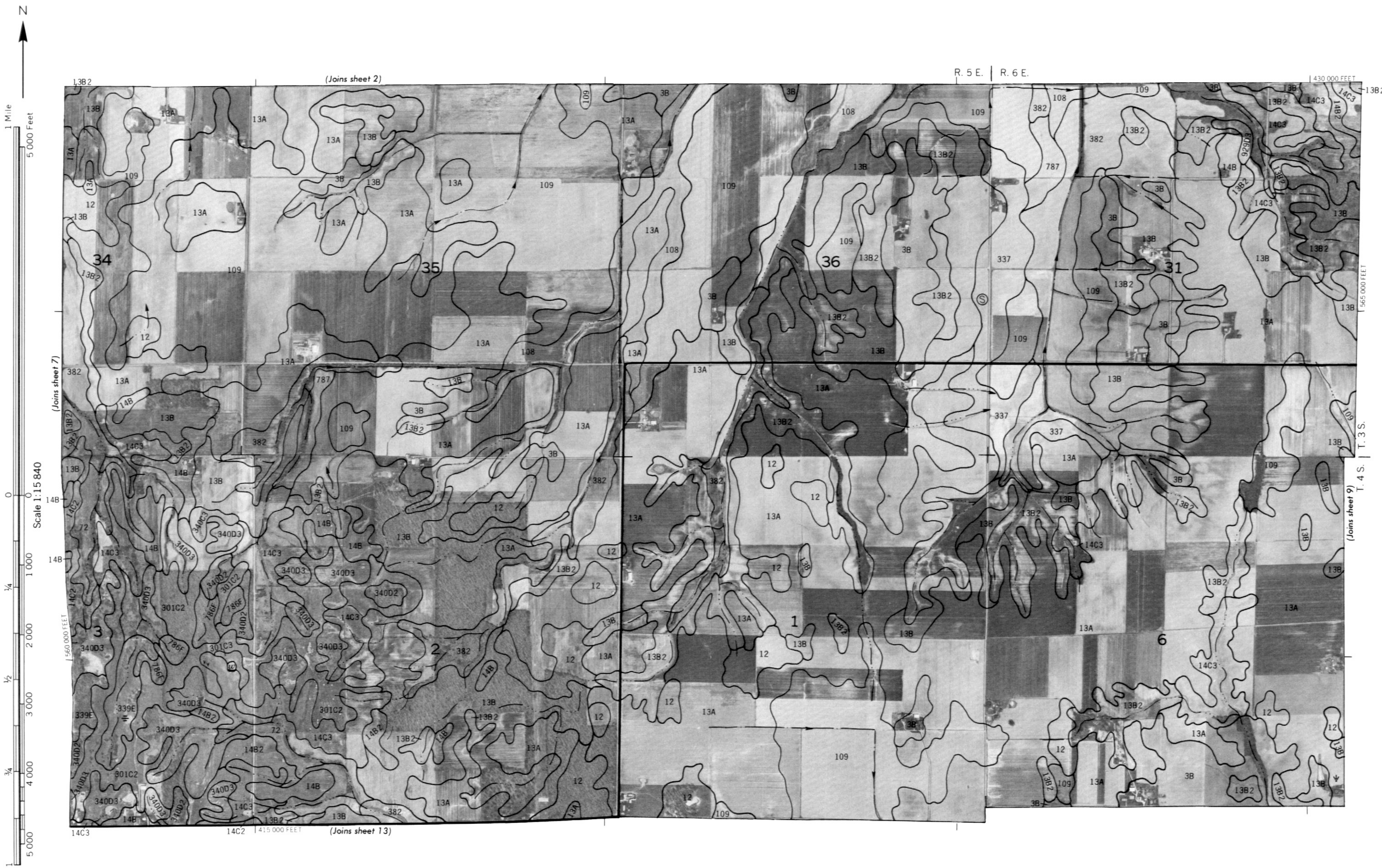


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

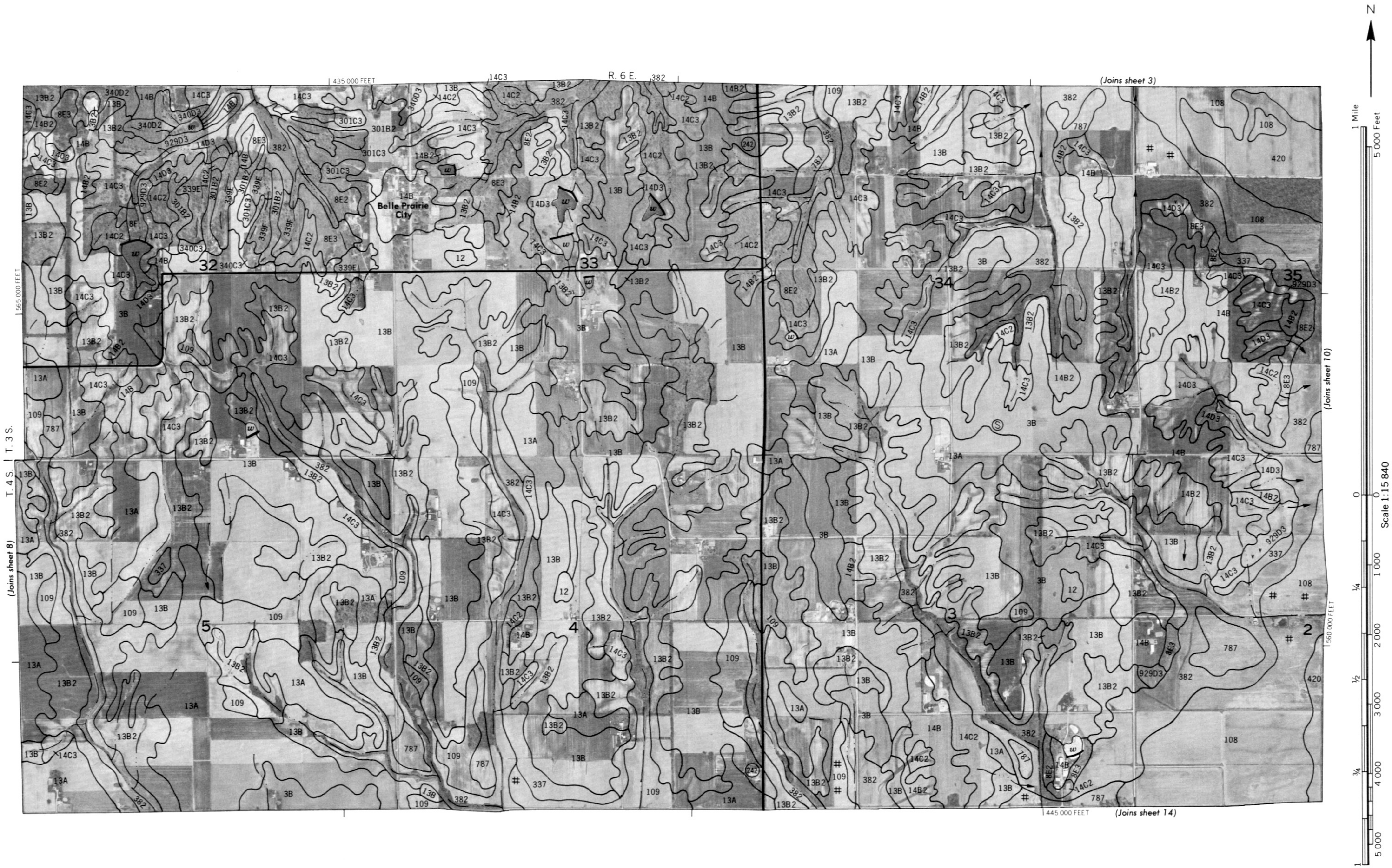


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 8



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

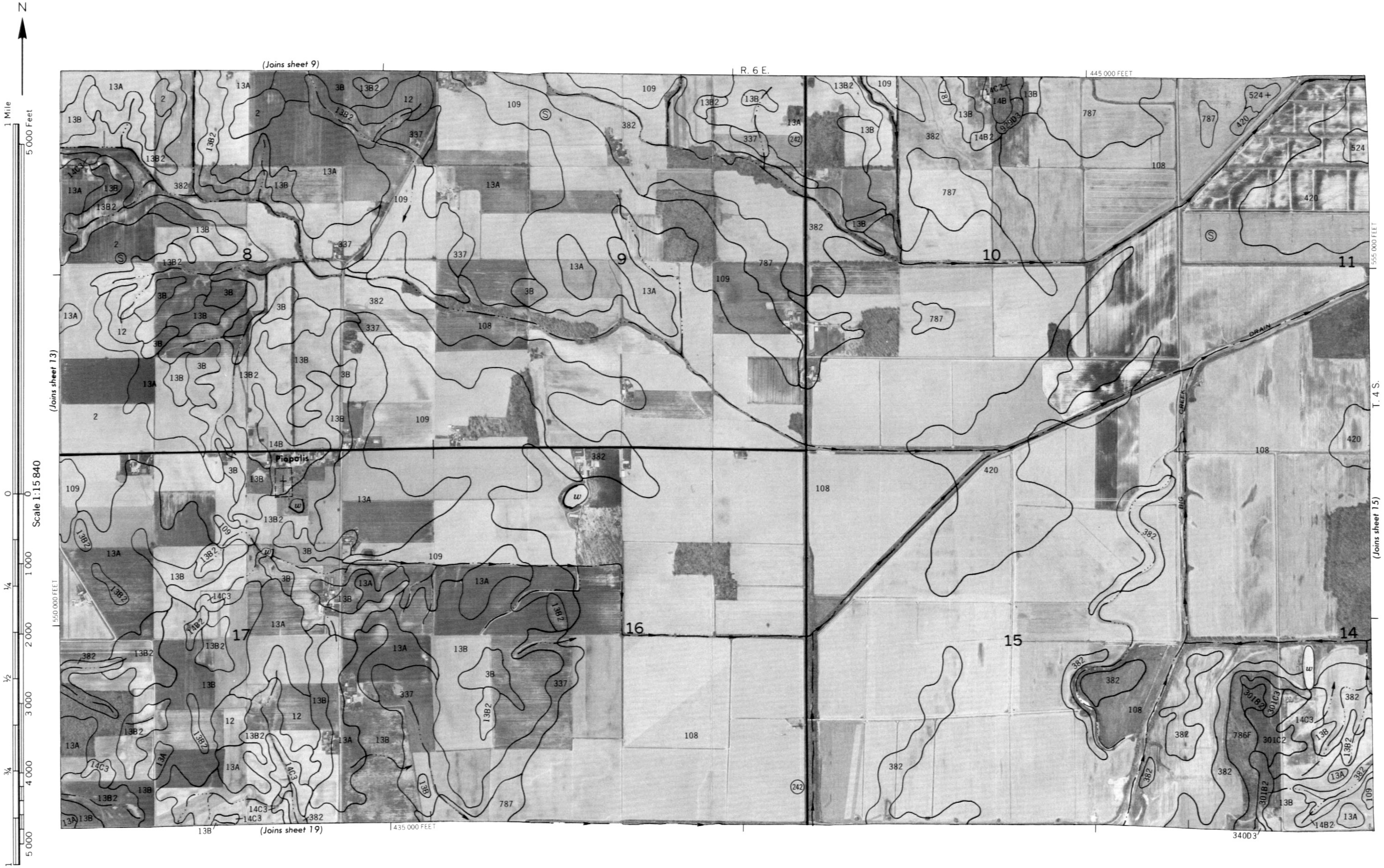
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 12

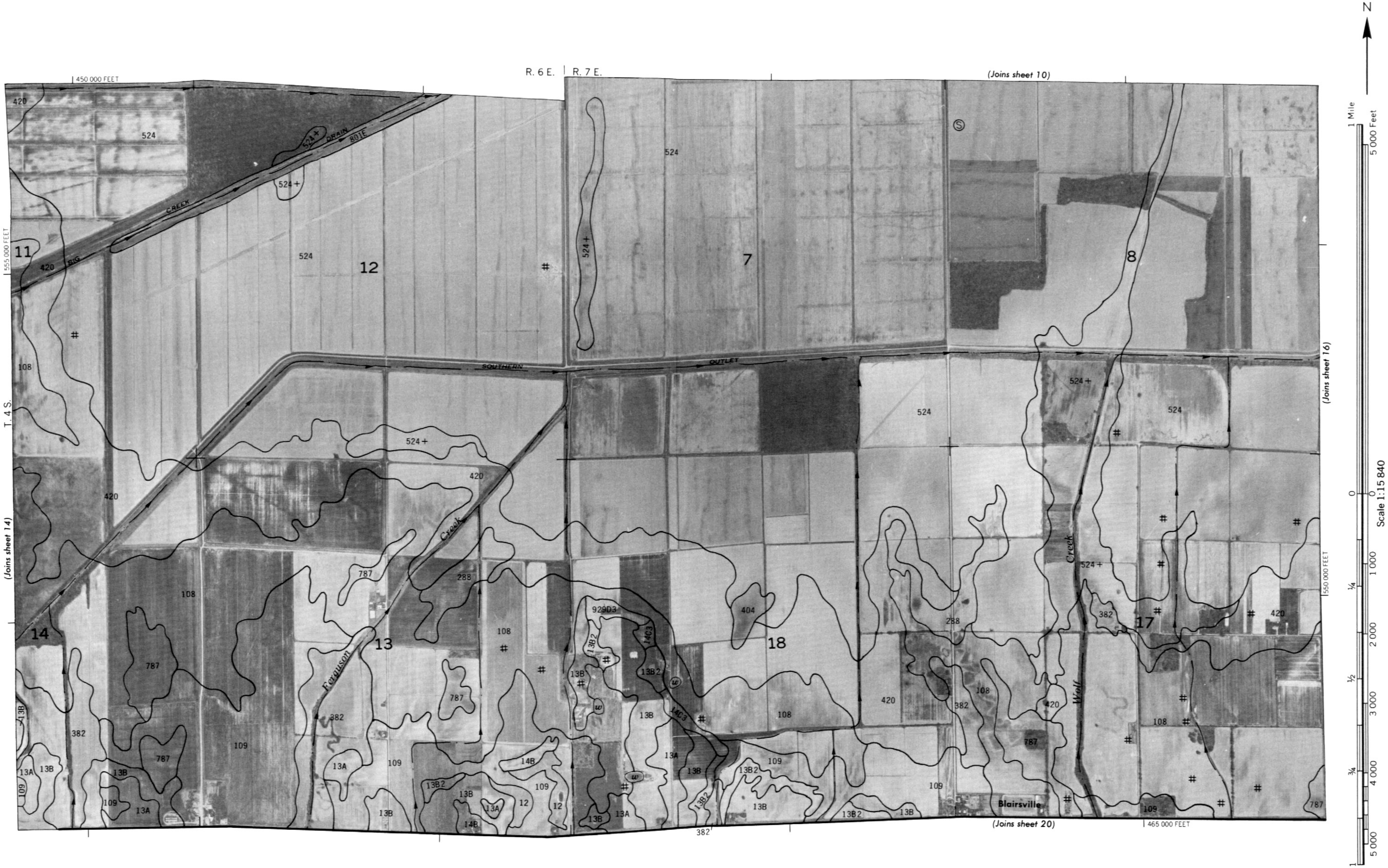
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 14

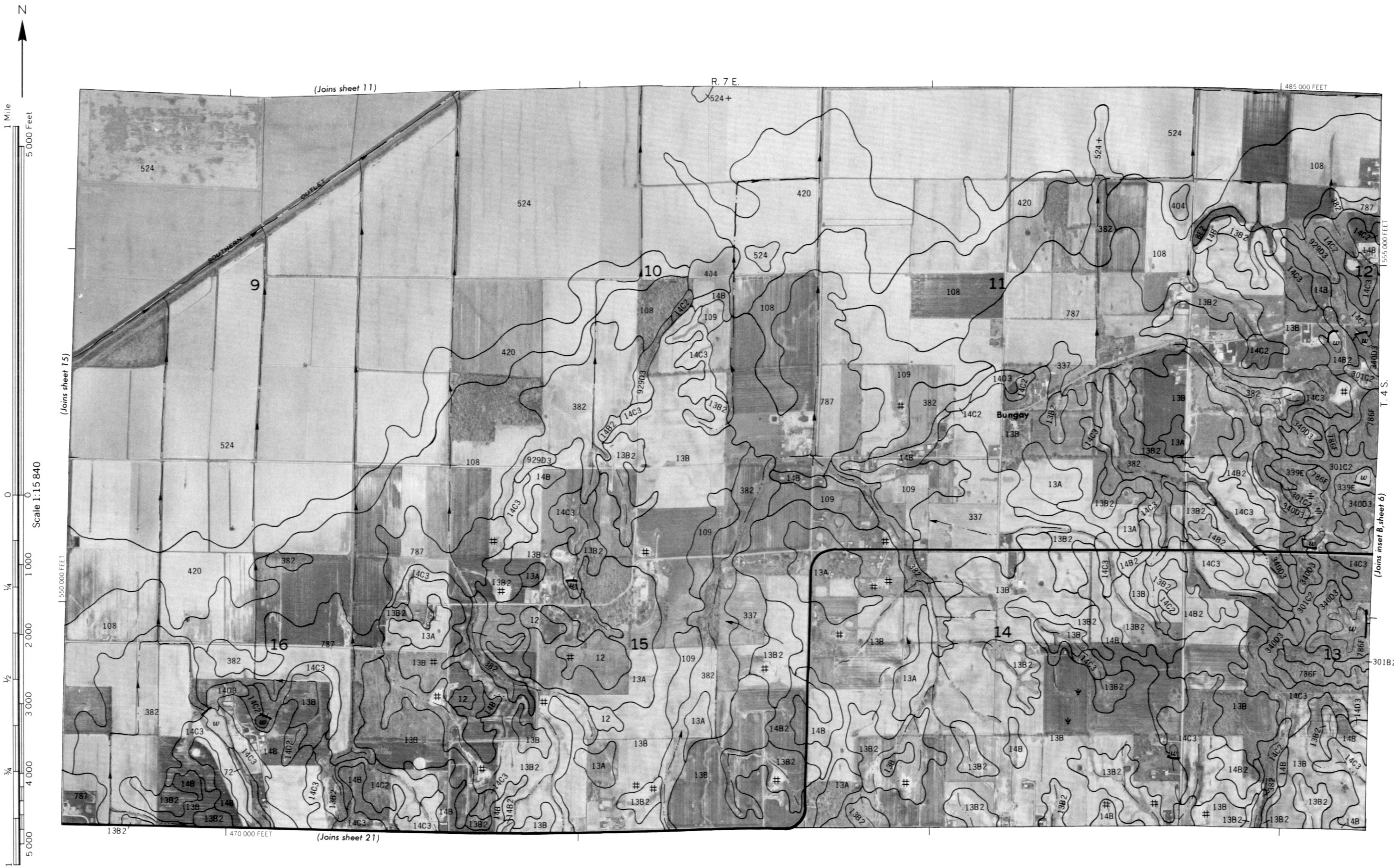


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

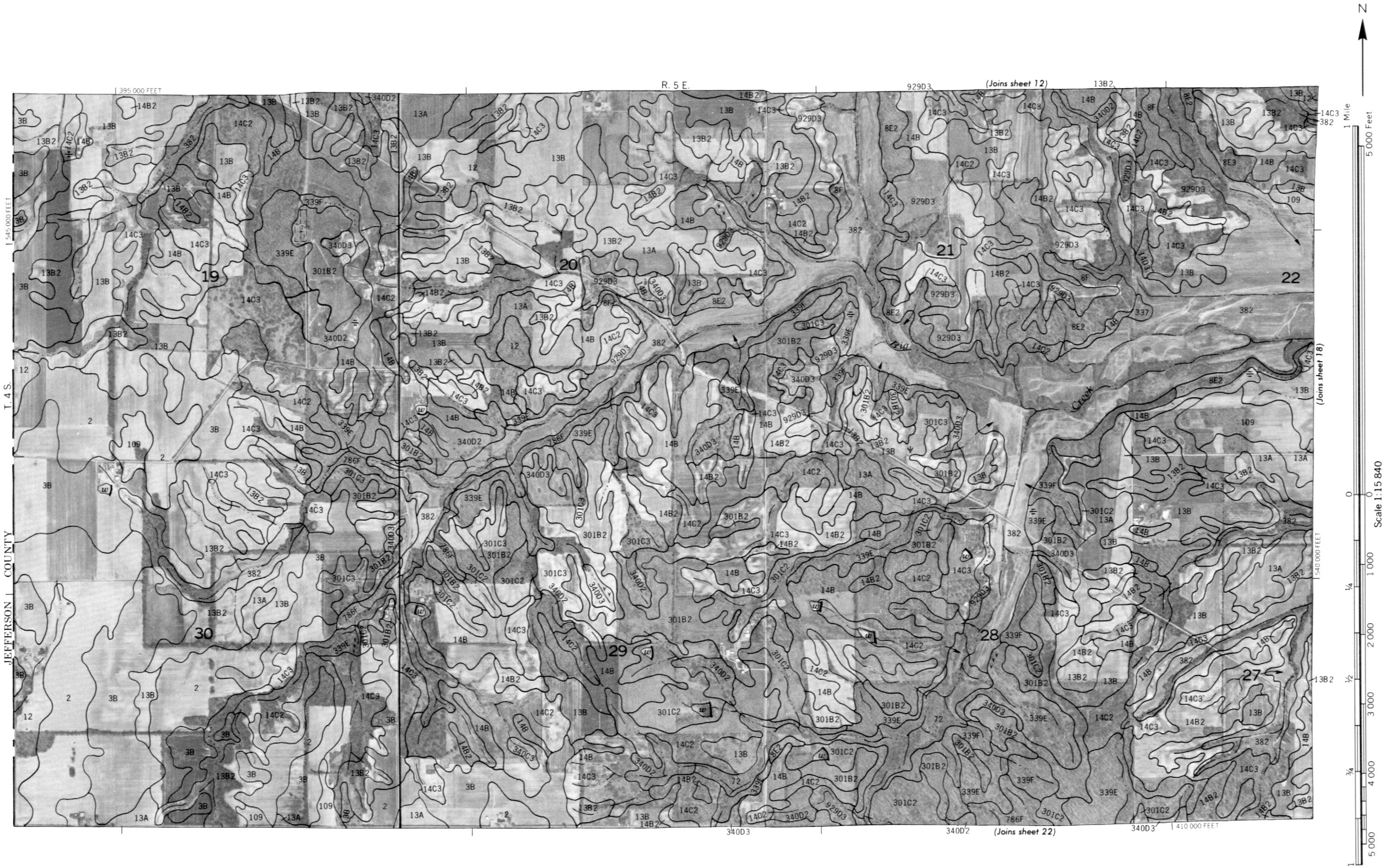


N
R. 6 E.
R. 7 E.
(Joins sheet 10)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 20)
T. 4 S.
450 000 FEET
555 000 FEET
550 000 FEET
465 000 FEET
BIG CREEK DRAIN
SOUTHERN OUTLET
Creek
Ferguson
Wolf Creek
Blairsville
11
12
7
8
14
13
18
17
420
524
524+
108
787
109
382
13A
13B
13B2
14B
288
404
929D3
14C3
12
Scale 1:15 840
1 Mile
5 000 Feet

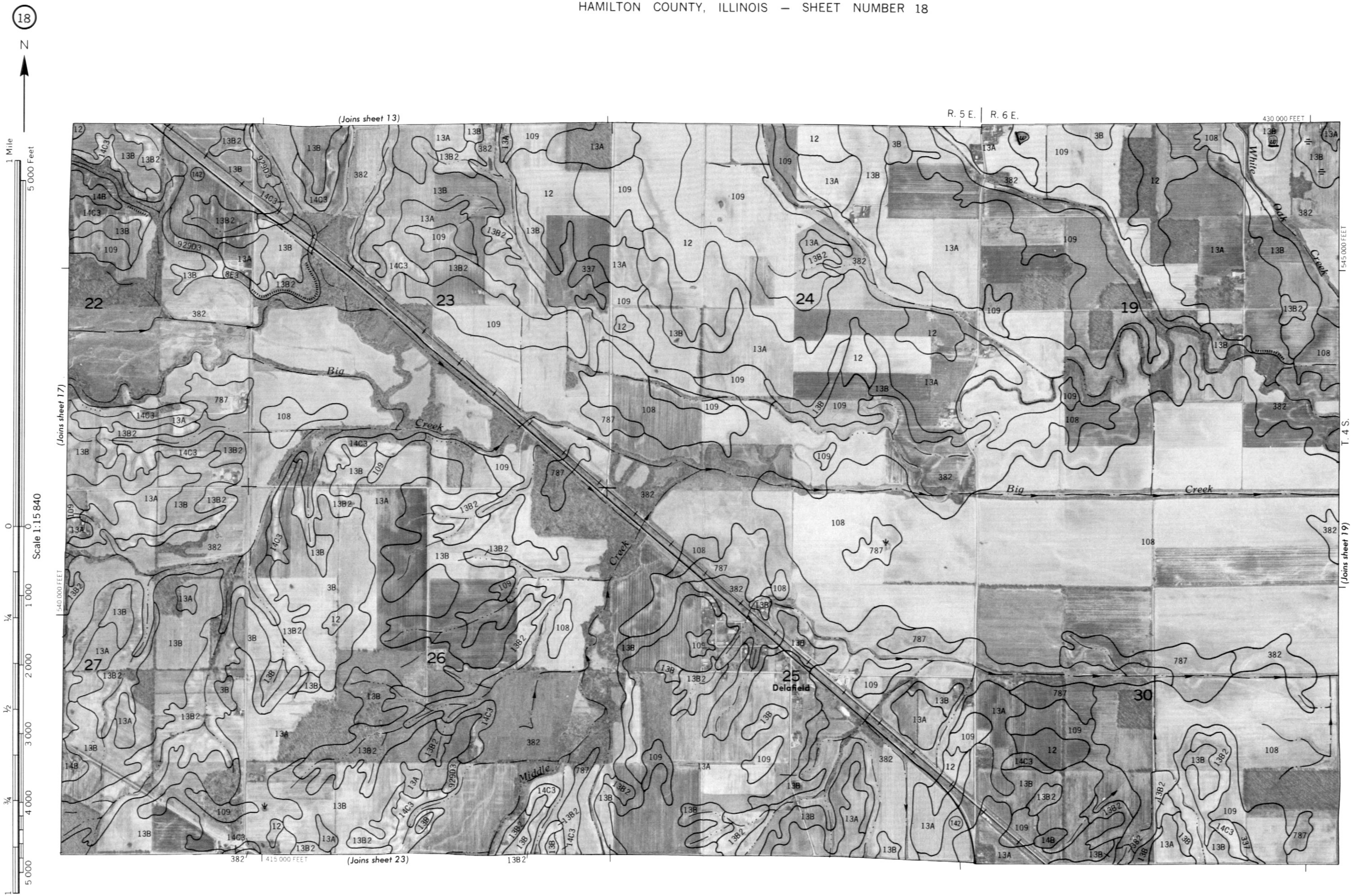
HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 16



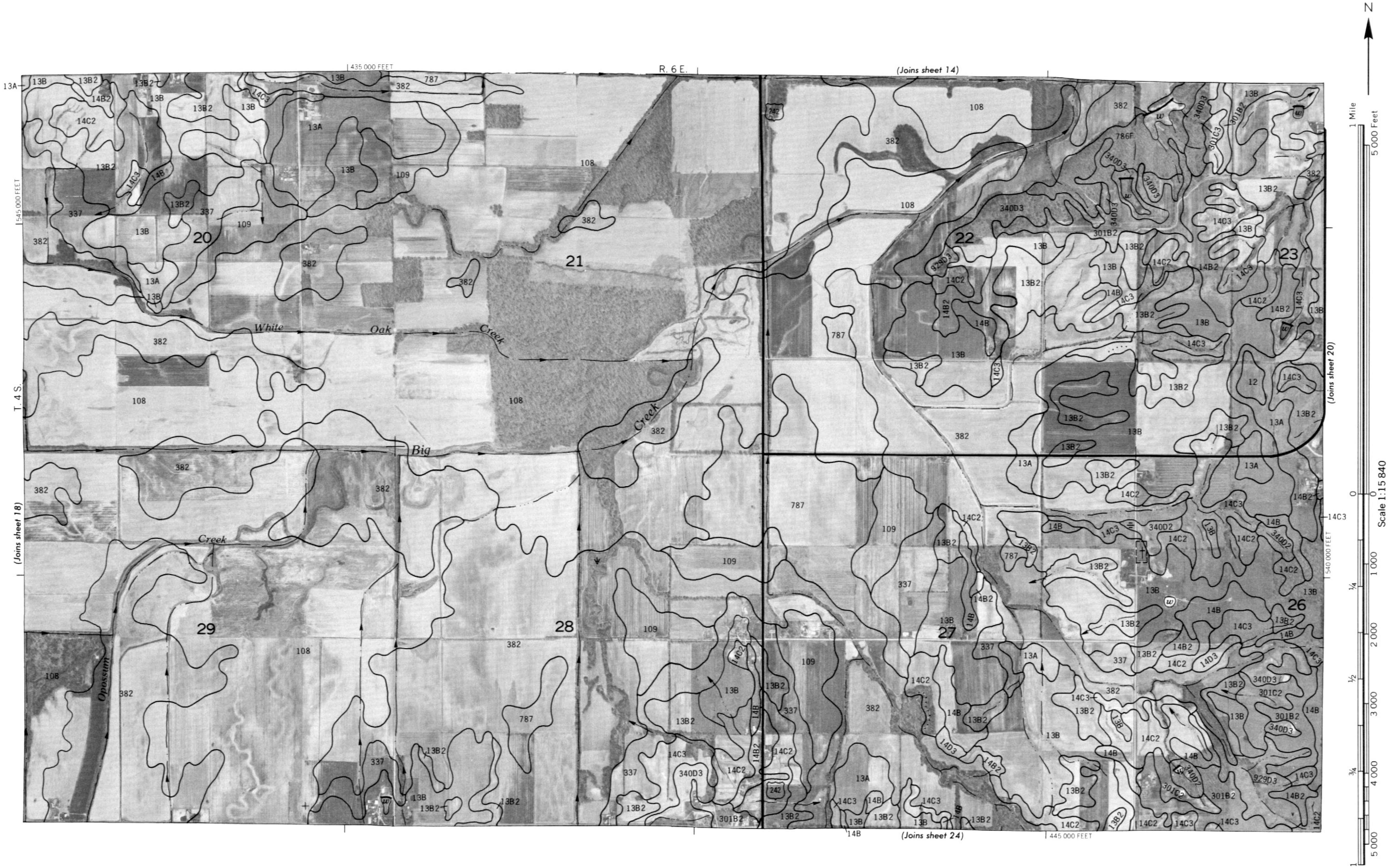
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



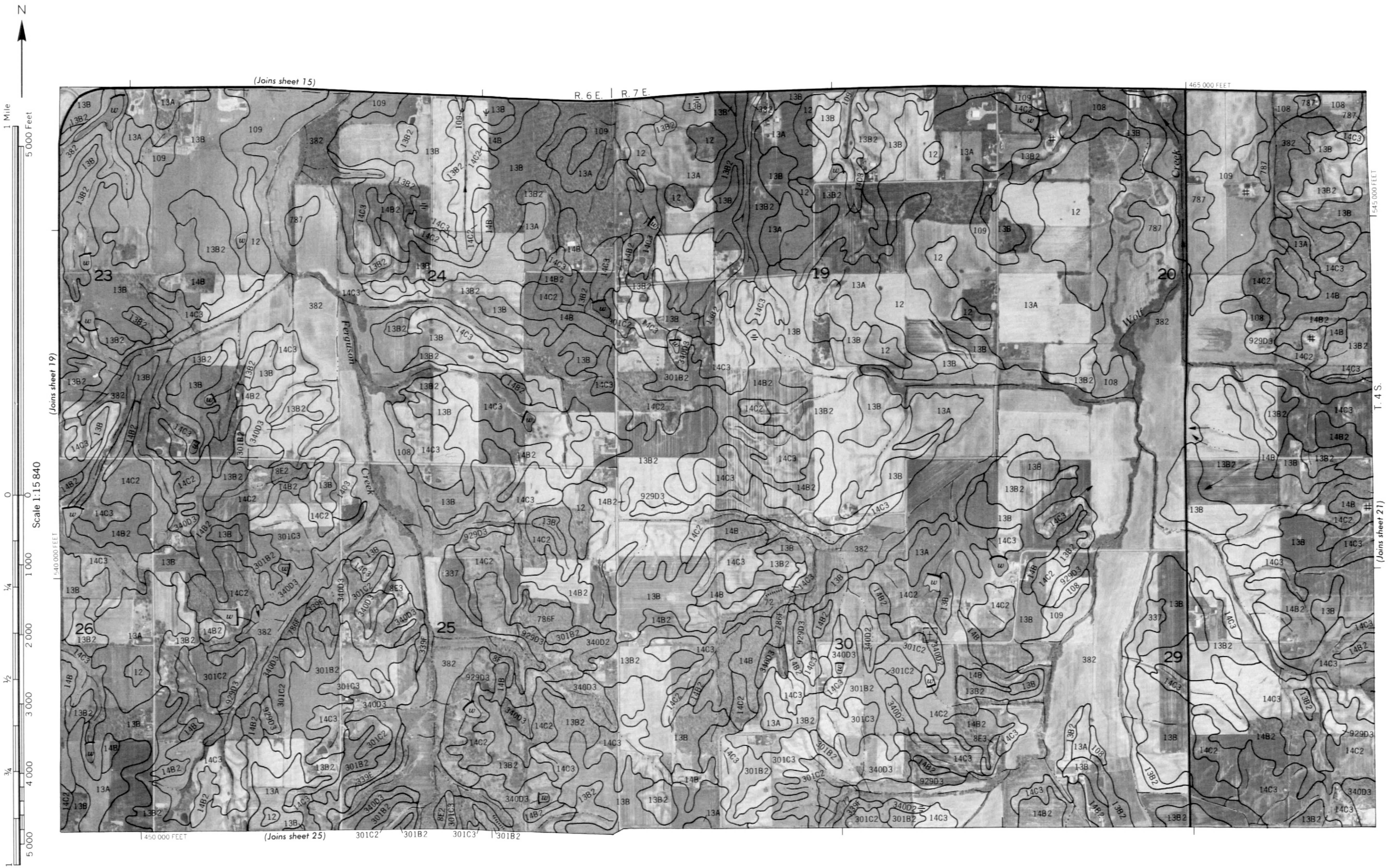
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



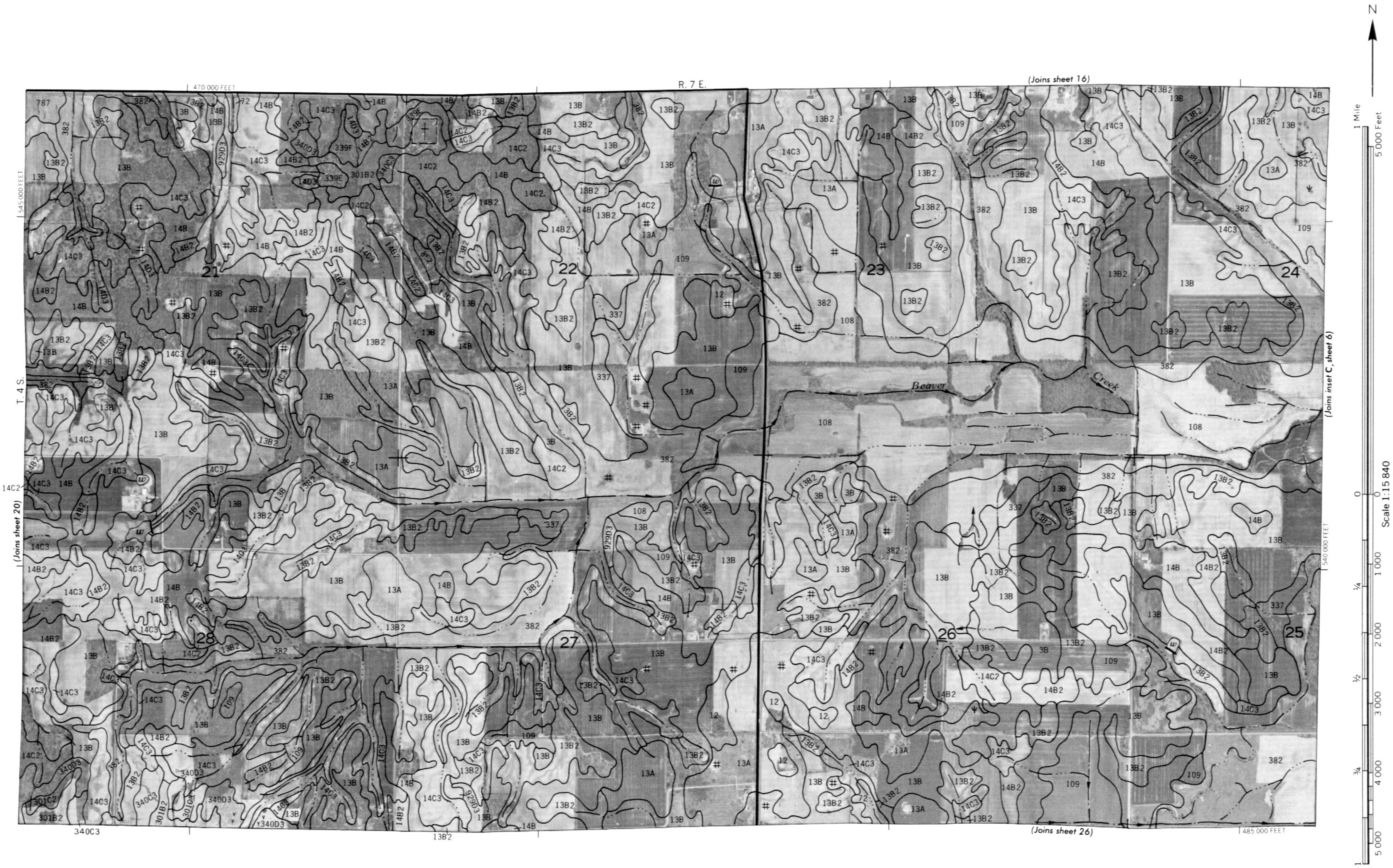
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



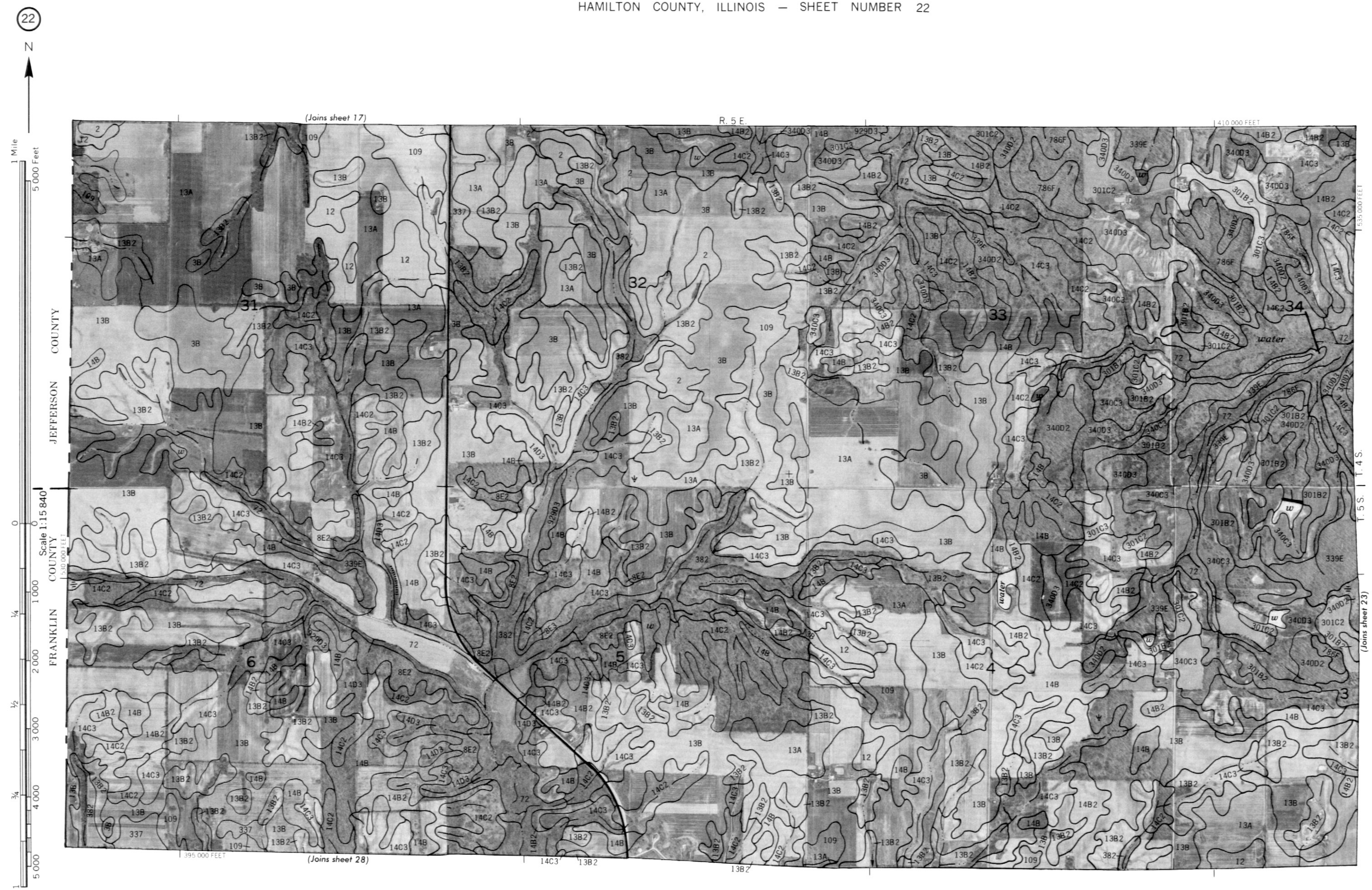
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



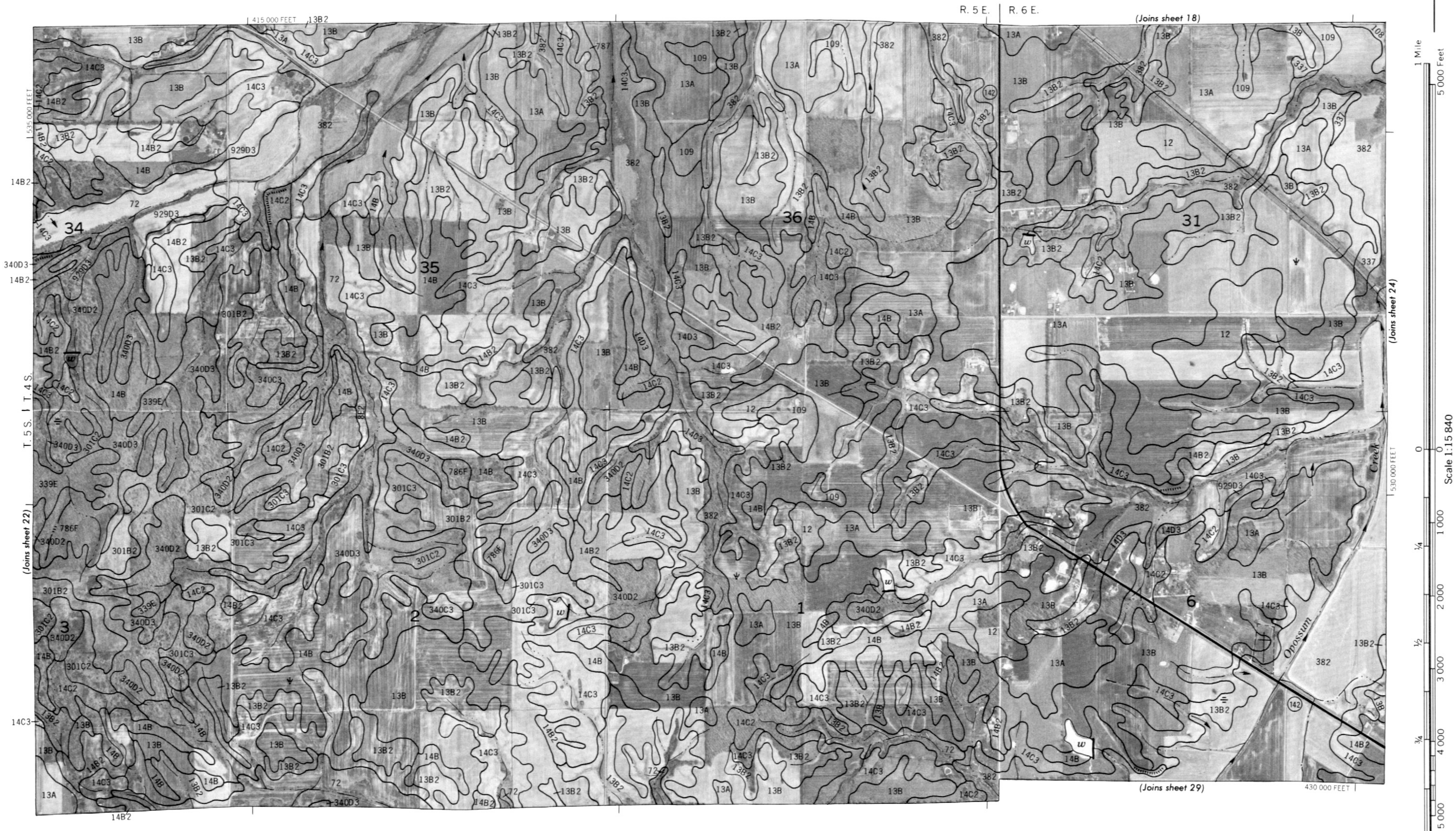
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



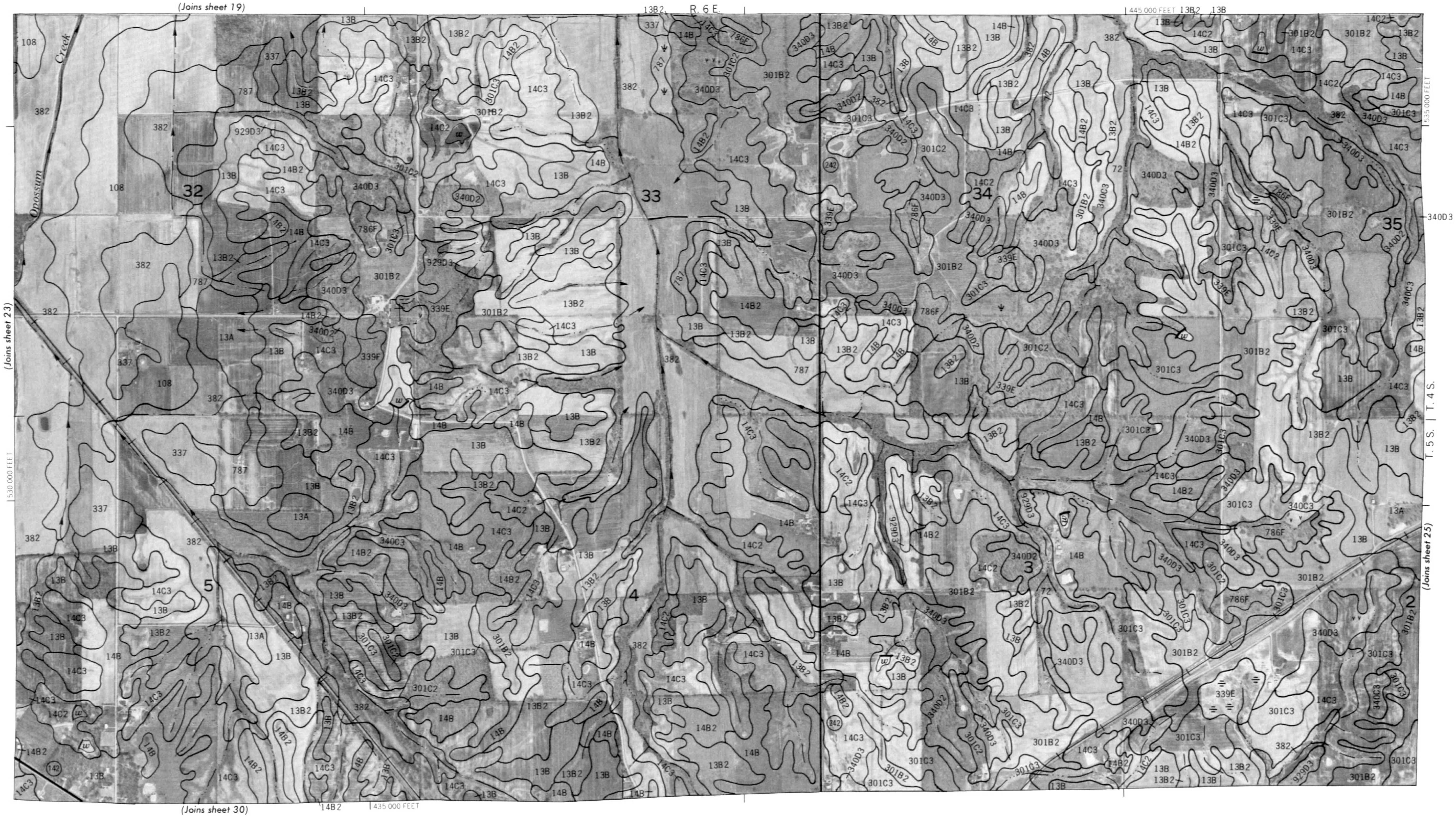
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 24

N



Scale 1:15 840

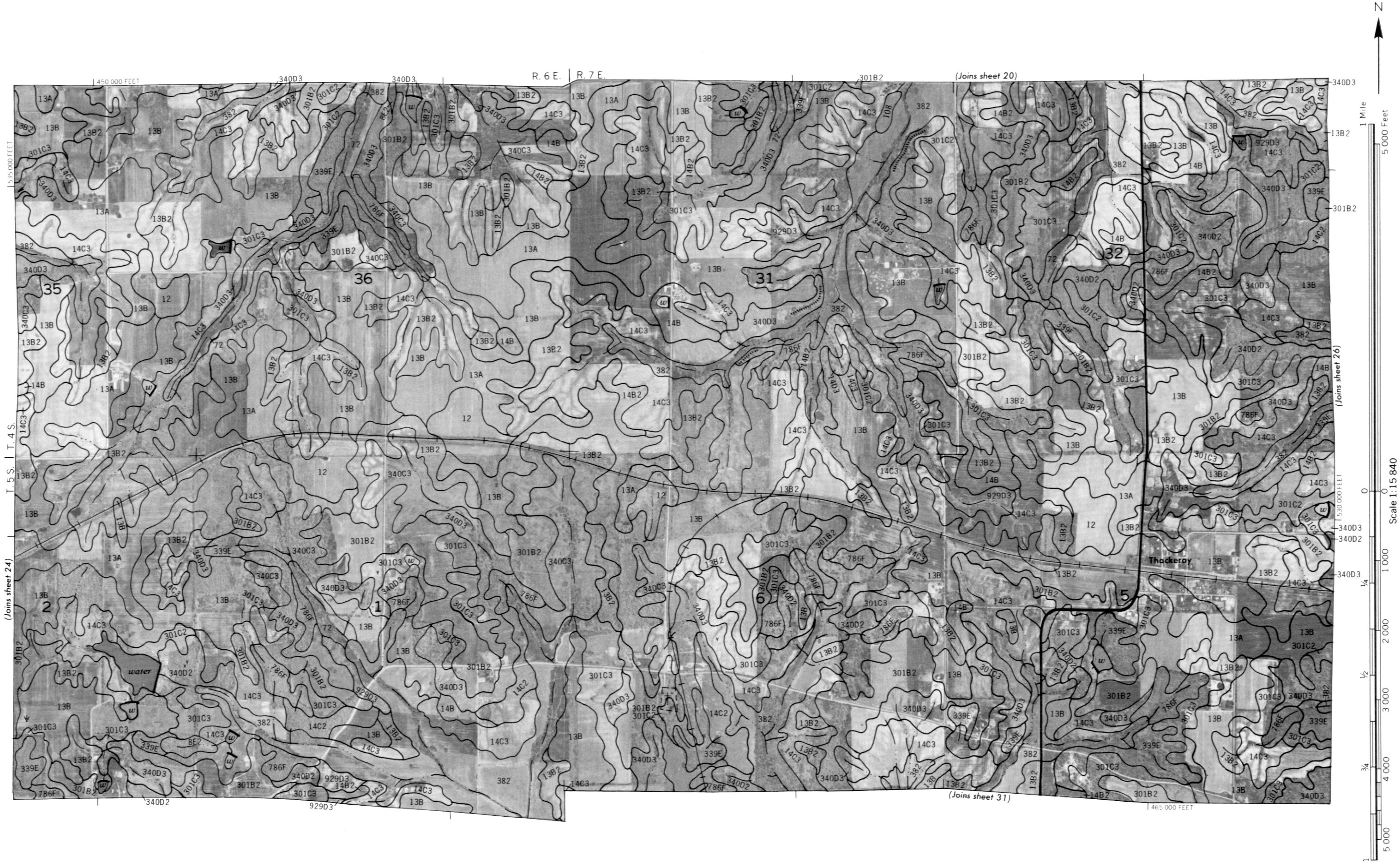
1 Mile

5 000 Feet

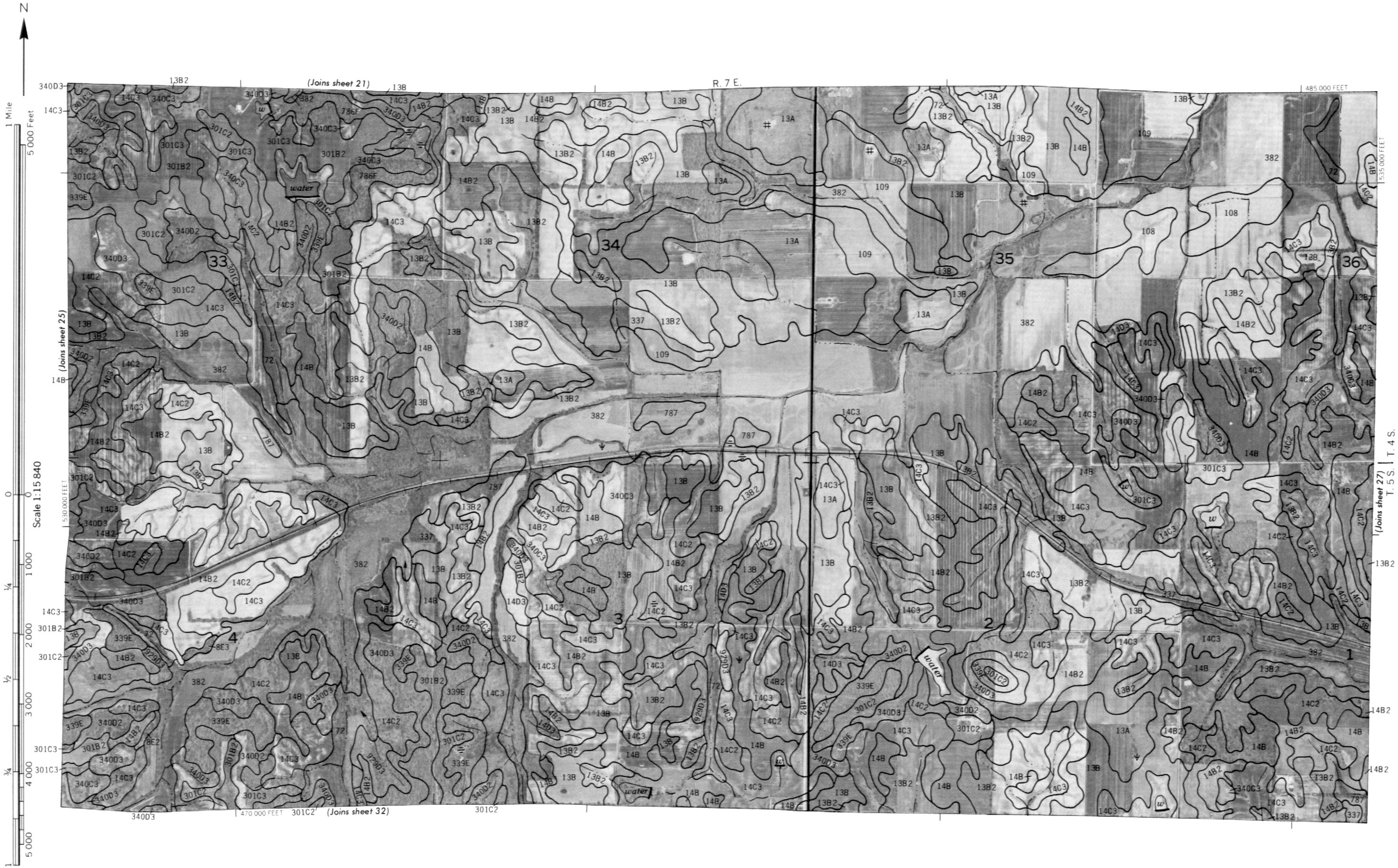
0 1 000 2 000 3 000 4 000 5 000

0 ¼ ½ ¾ 1

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

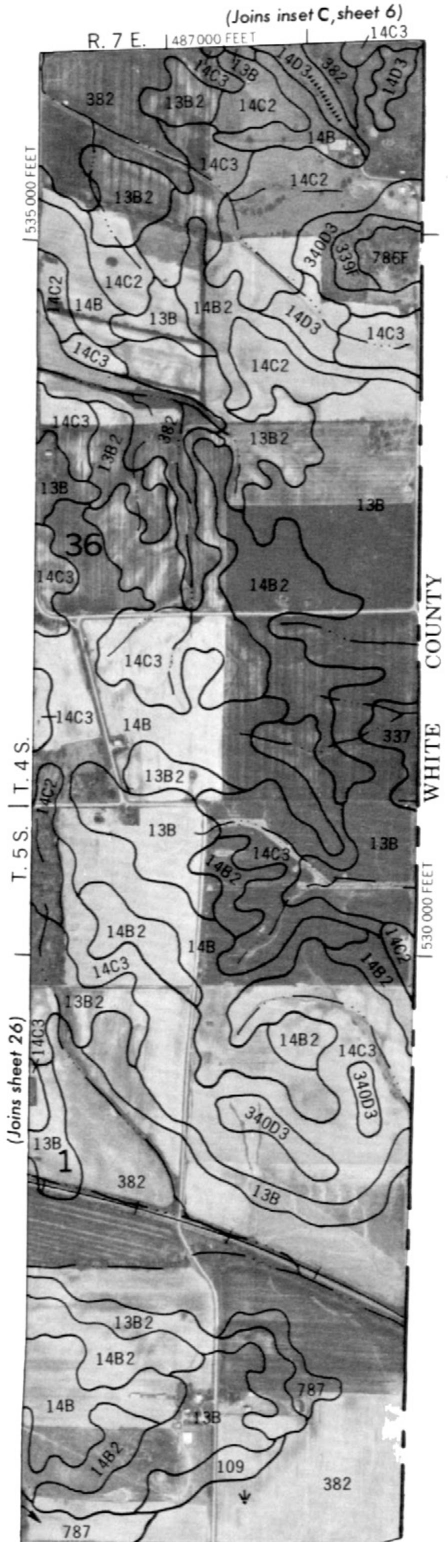


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



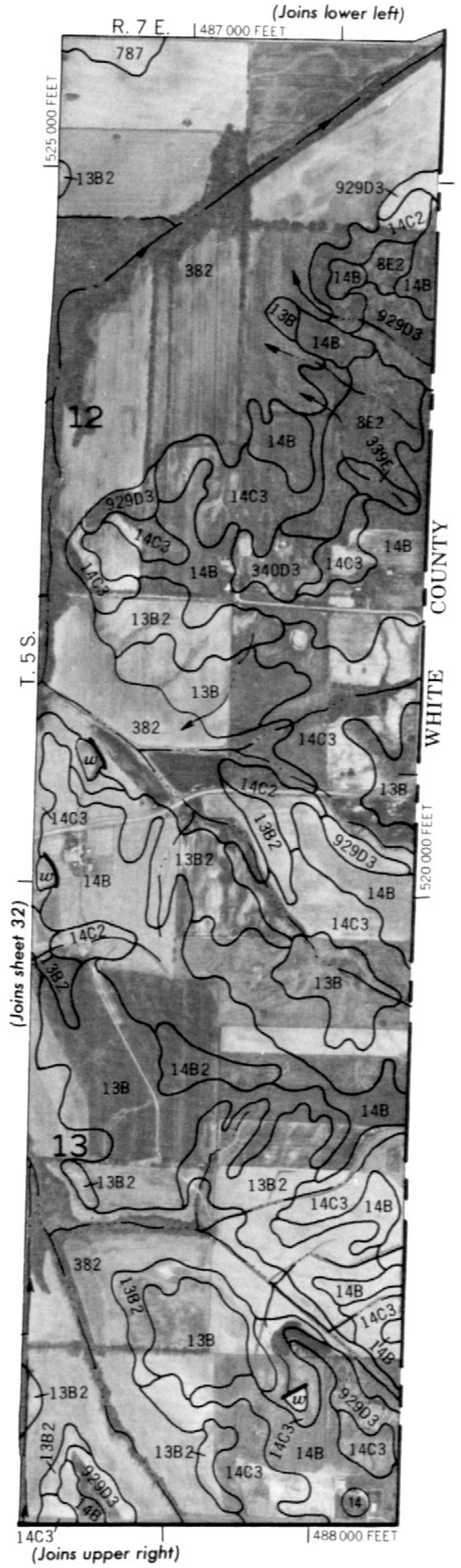
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



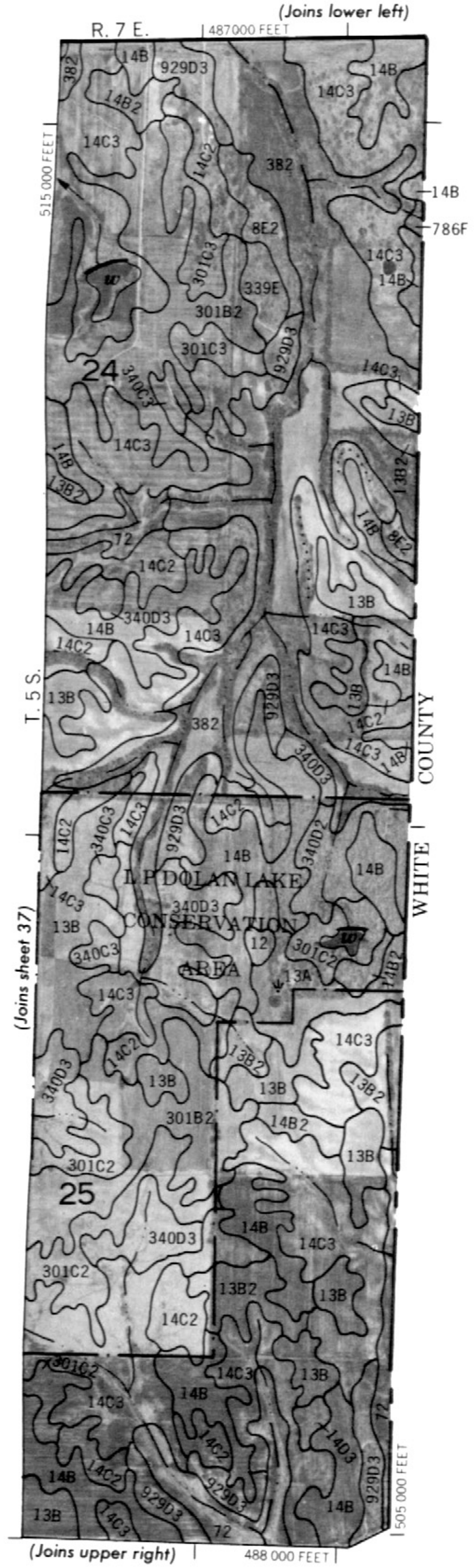
1000 AND 5000-FOOT GRID TICKS

INSET A



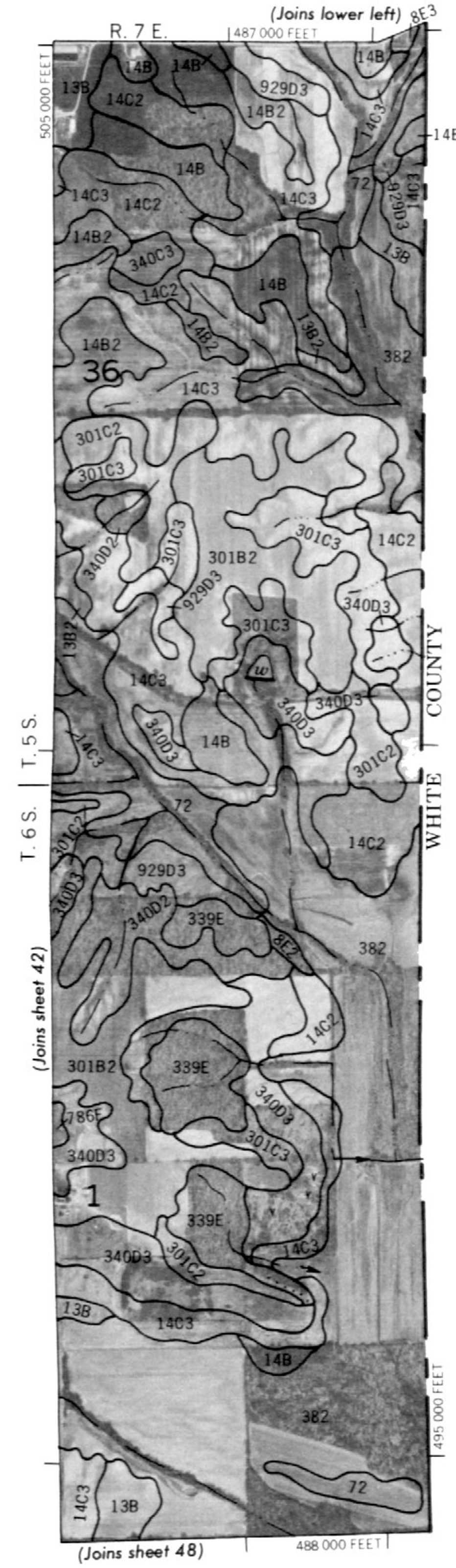
1000 AND 5000-FOOT GRID TICKS

INSET B

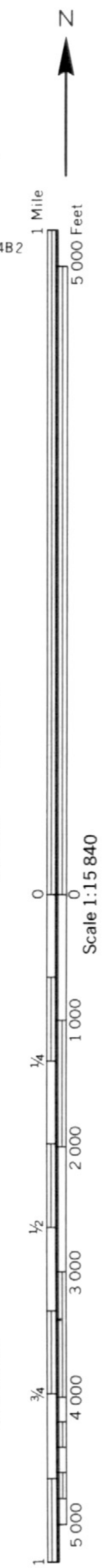


1000 AND 5000-FOOT GRID TICKS

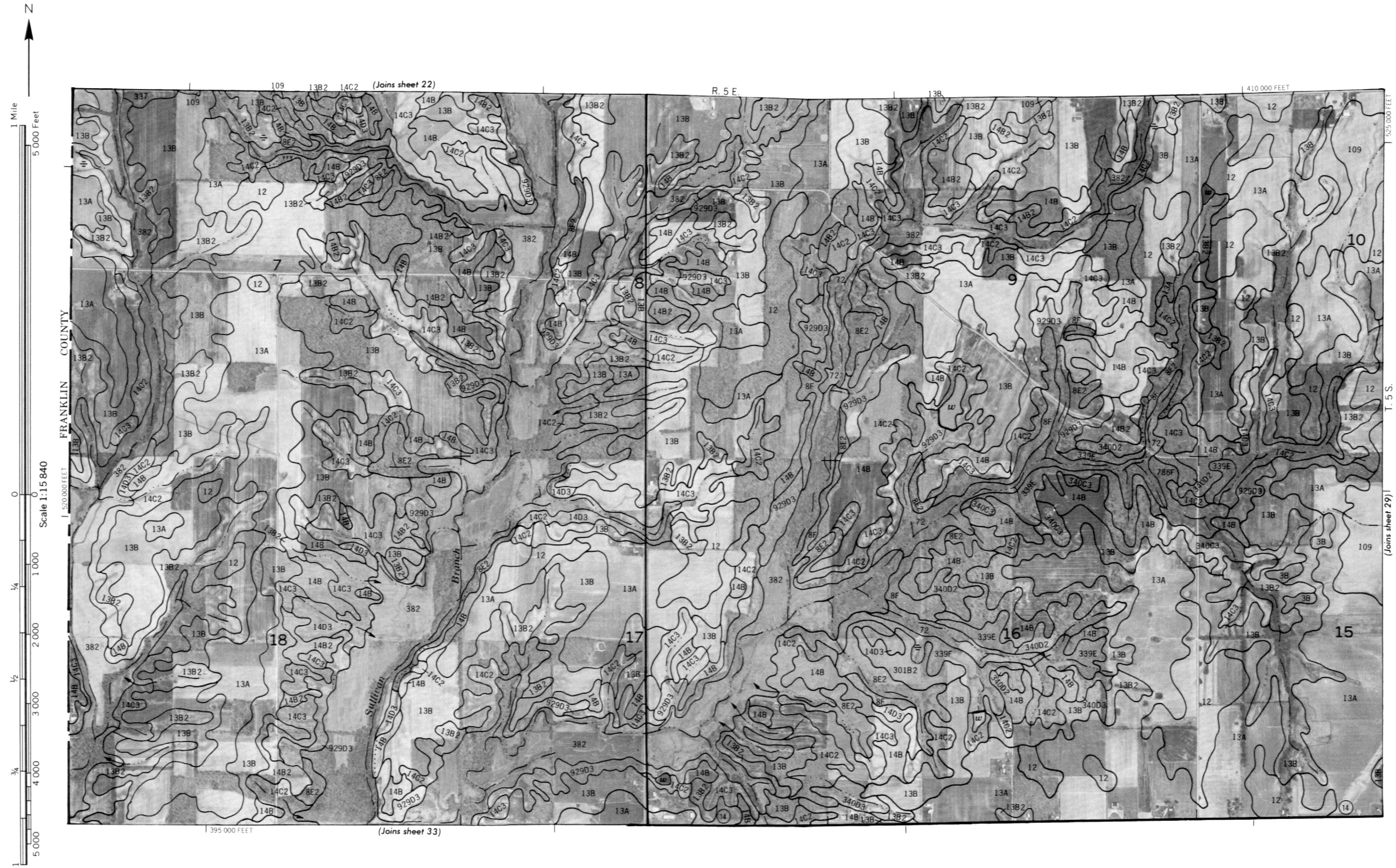
INSET C



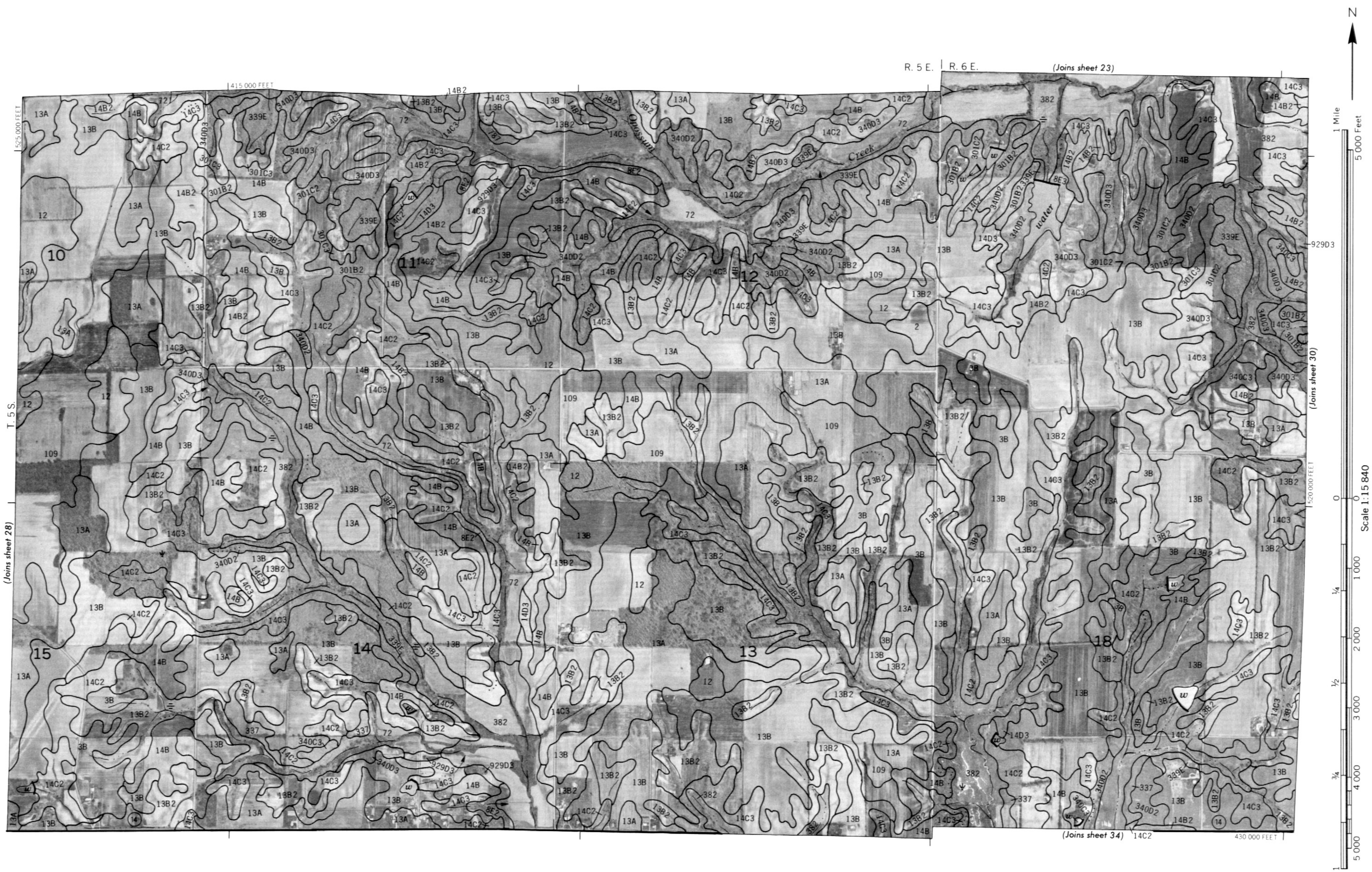
1000 AND 5000-FOOT GRID TICKS



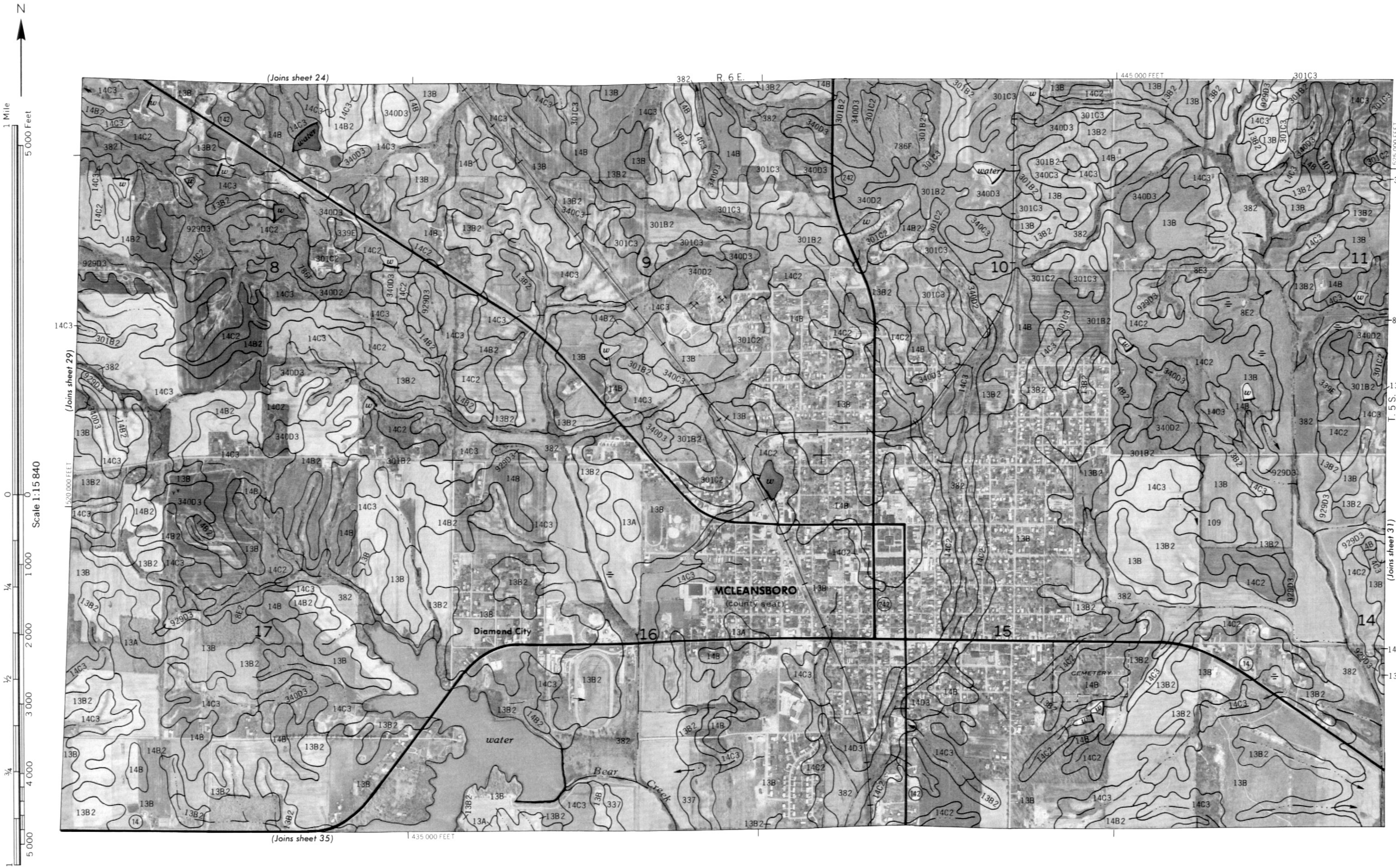
HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 28



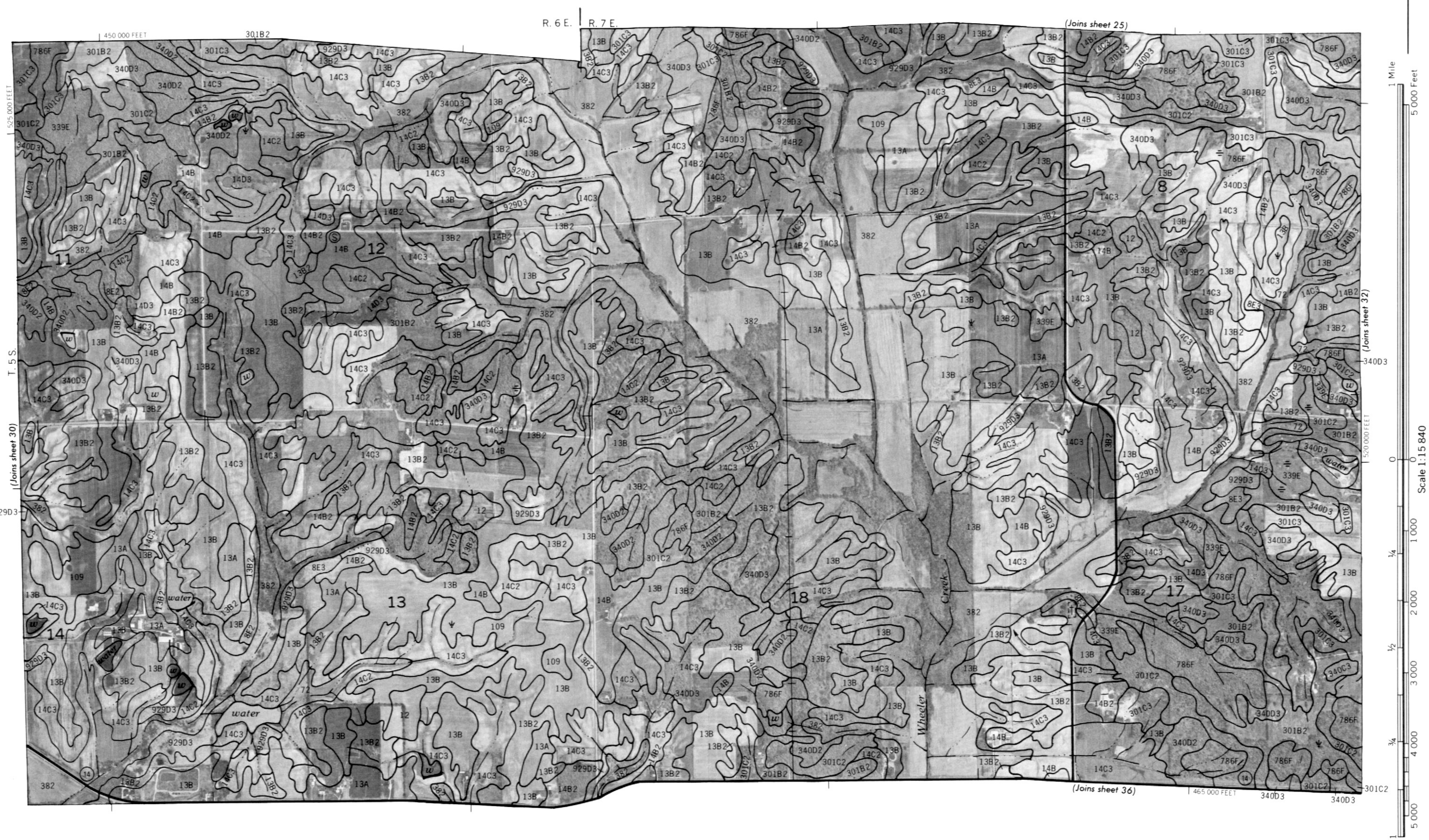
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



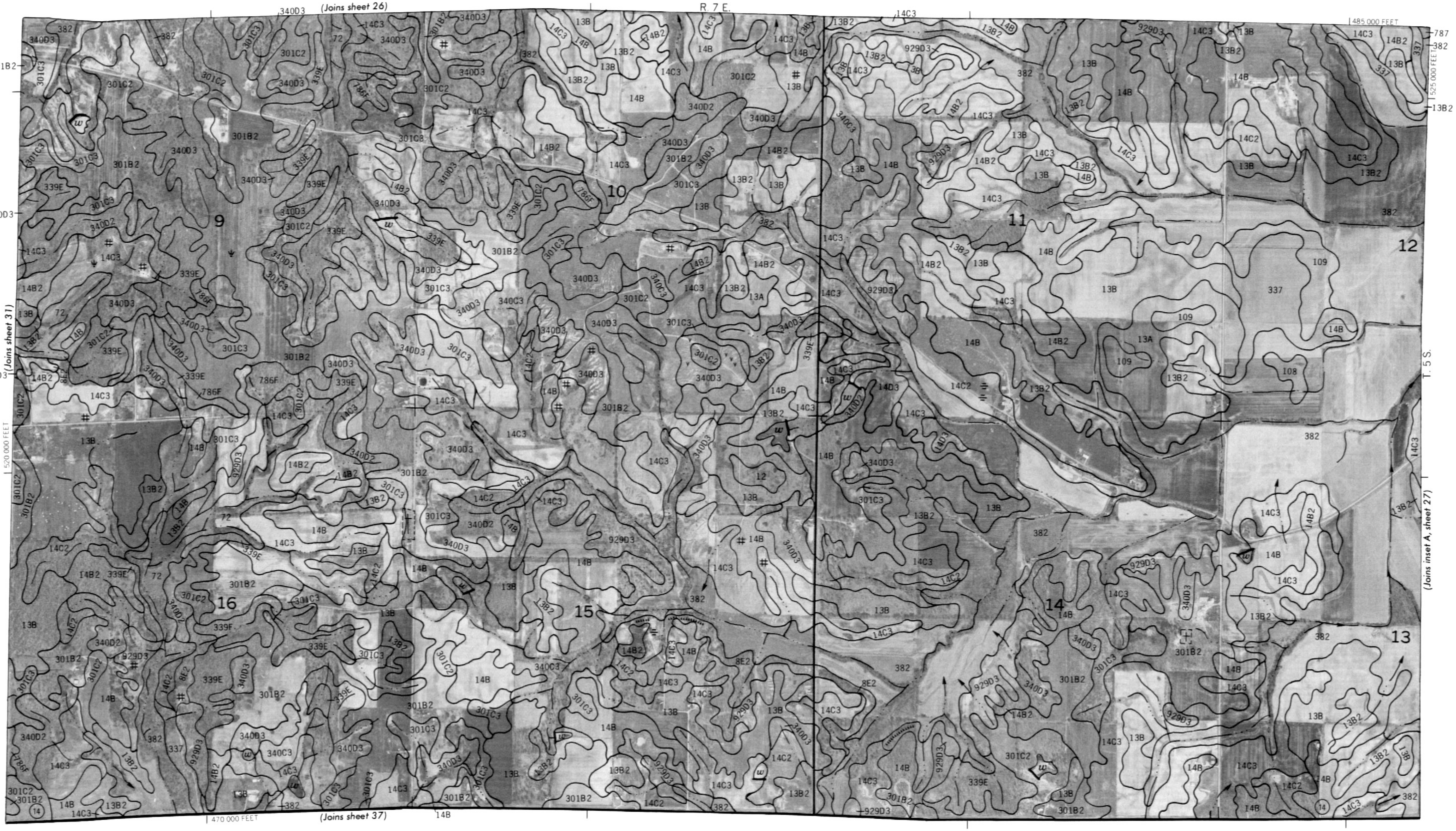
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

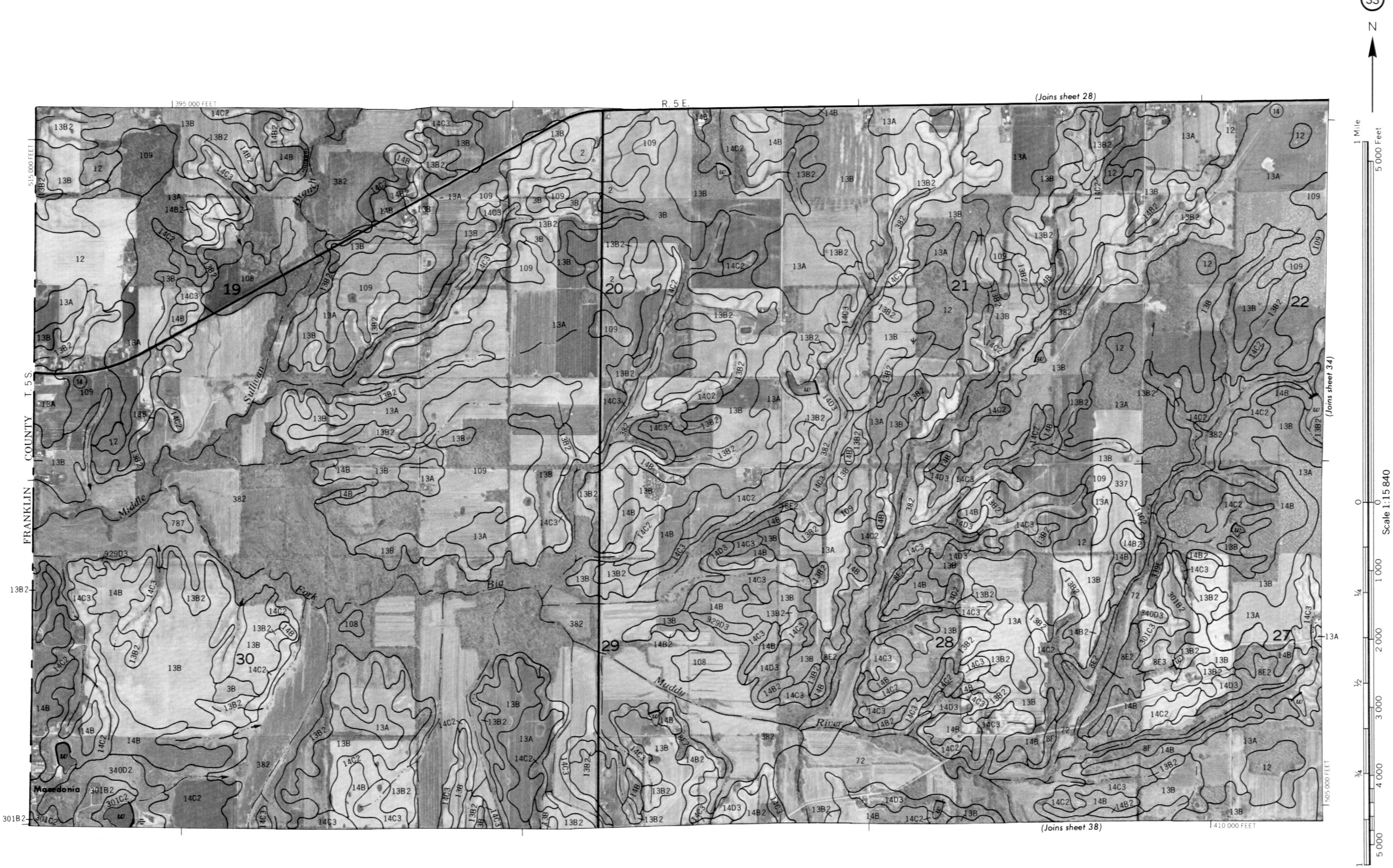
32

N



1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1
0
1000
2000
3000
4000
5000

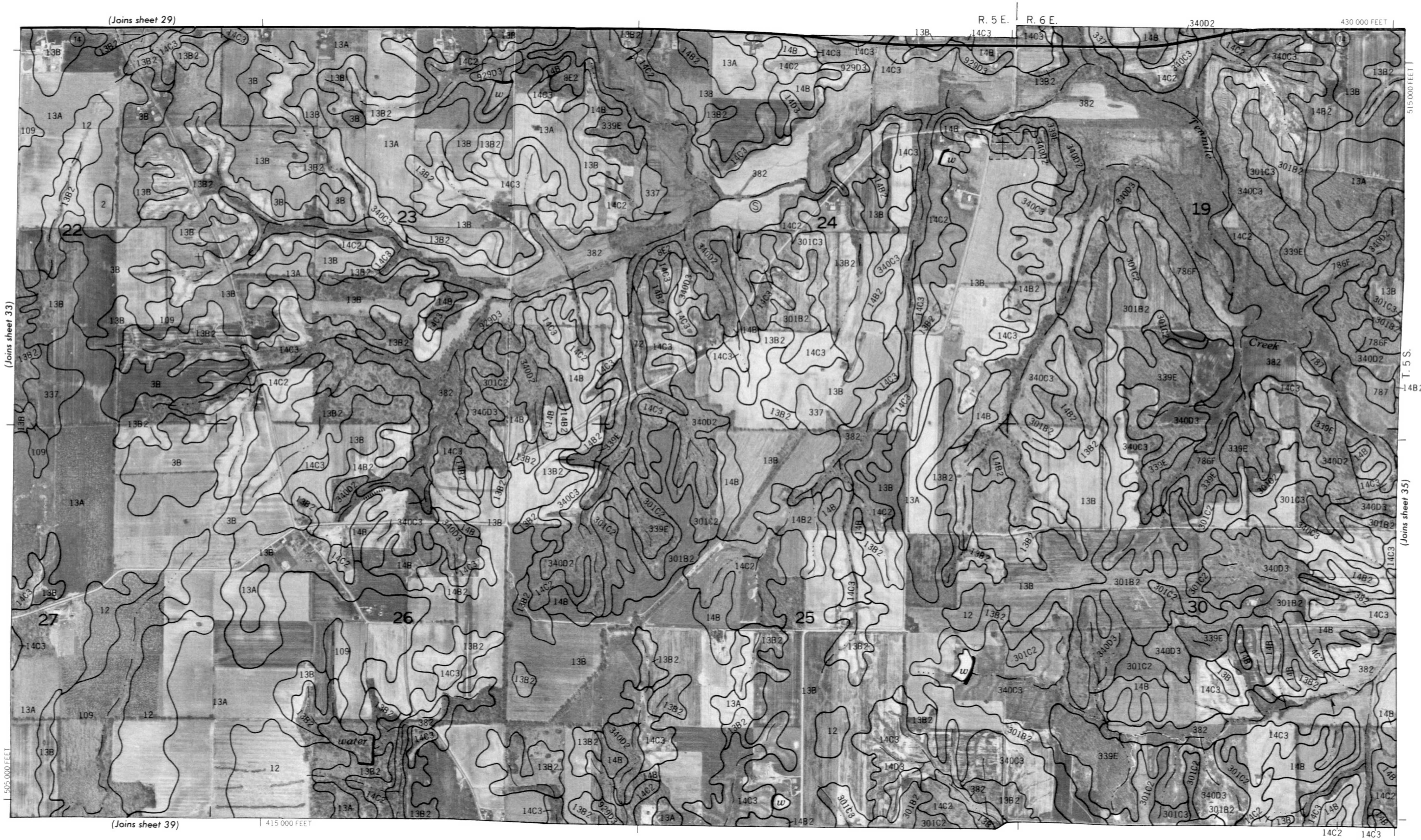
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

34

N



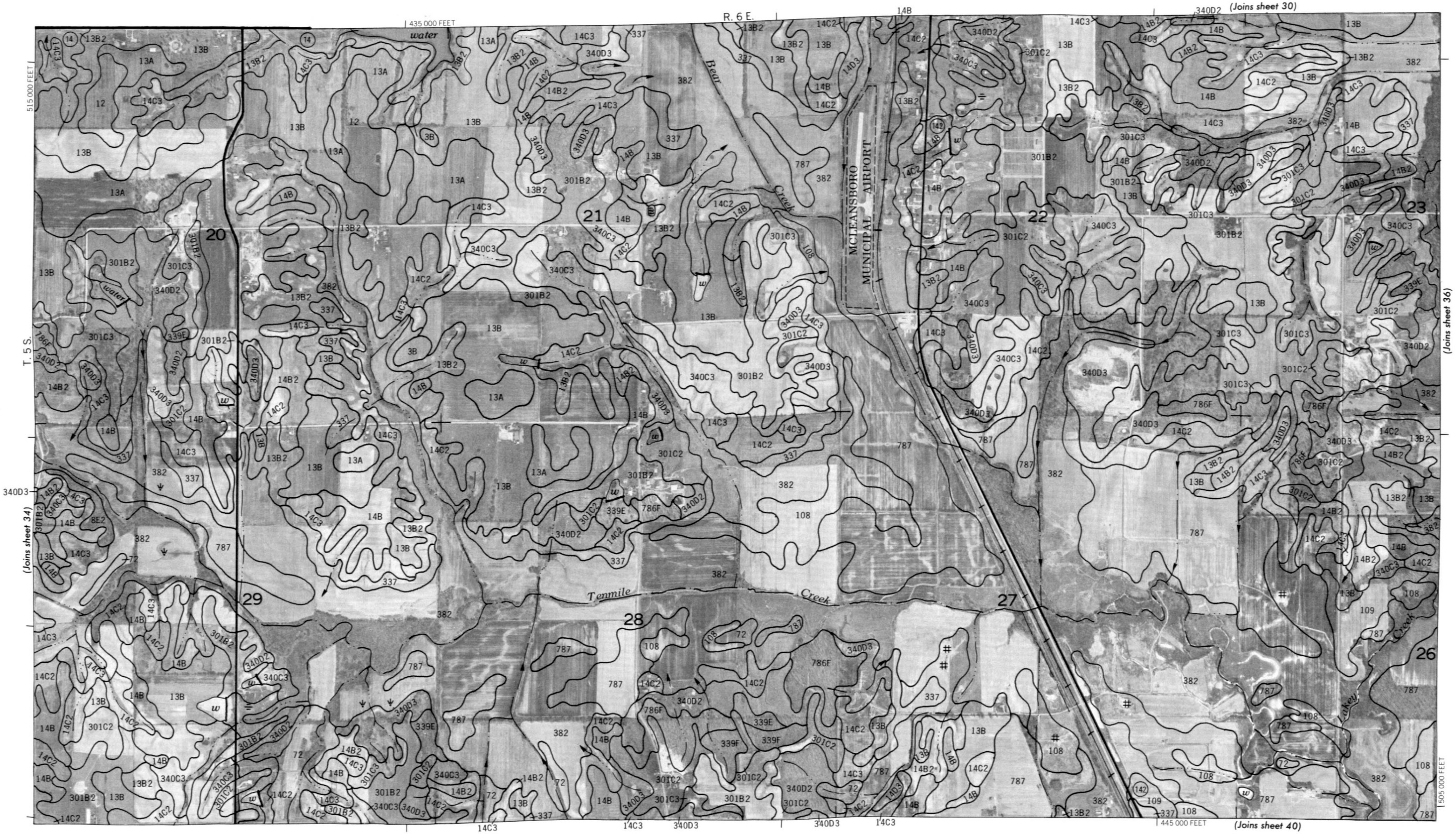
1 Mile

5 000 Feet

Scale 1:15 840

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

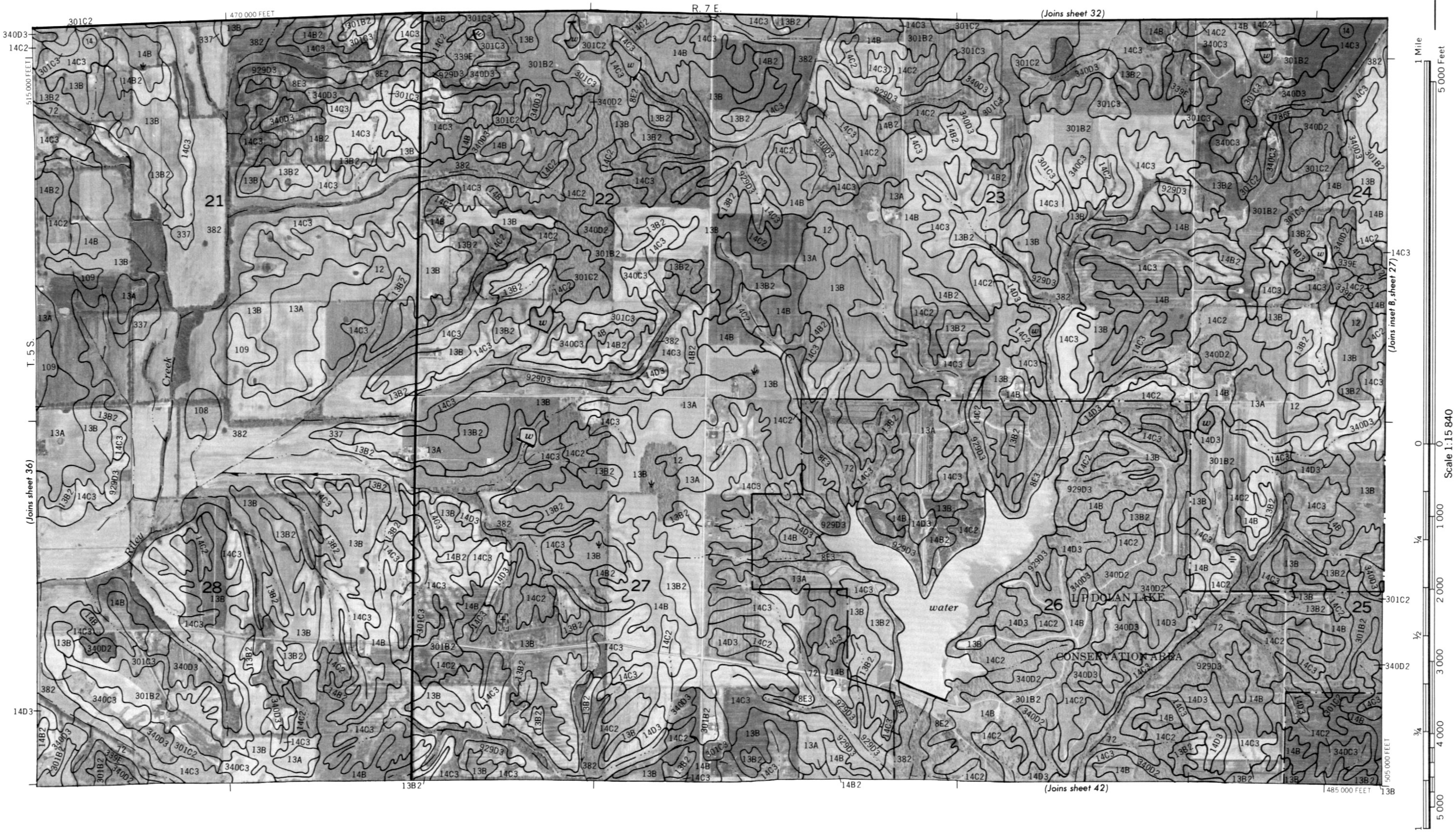


1 Mile
5 000 Feet
Scale 1:15 840
0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

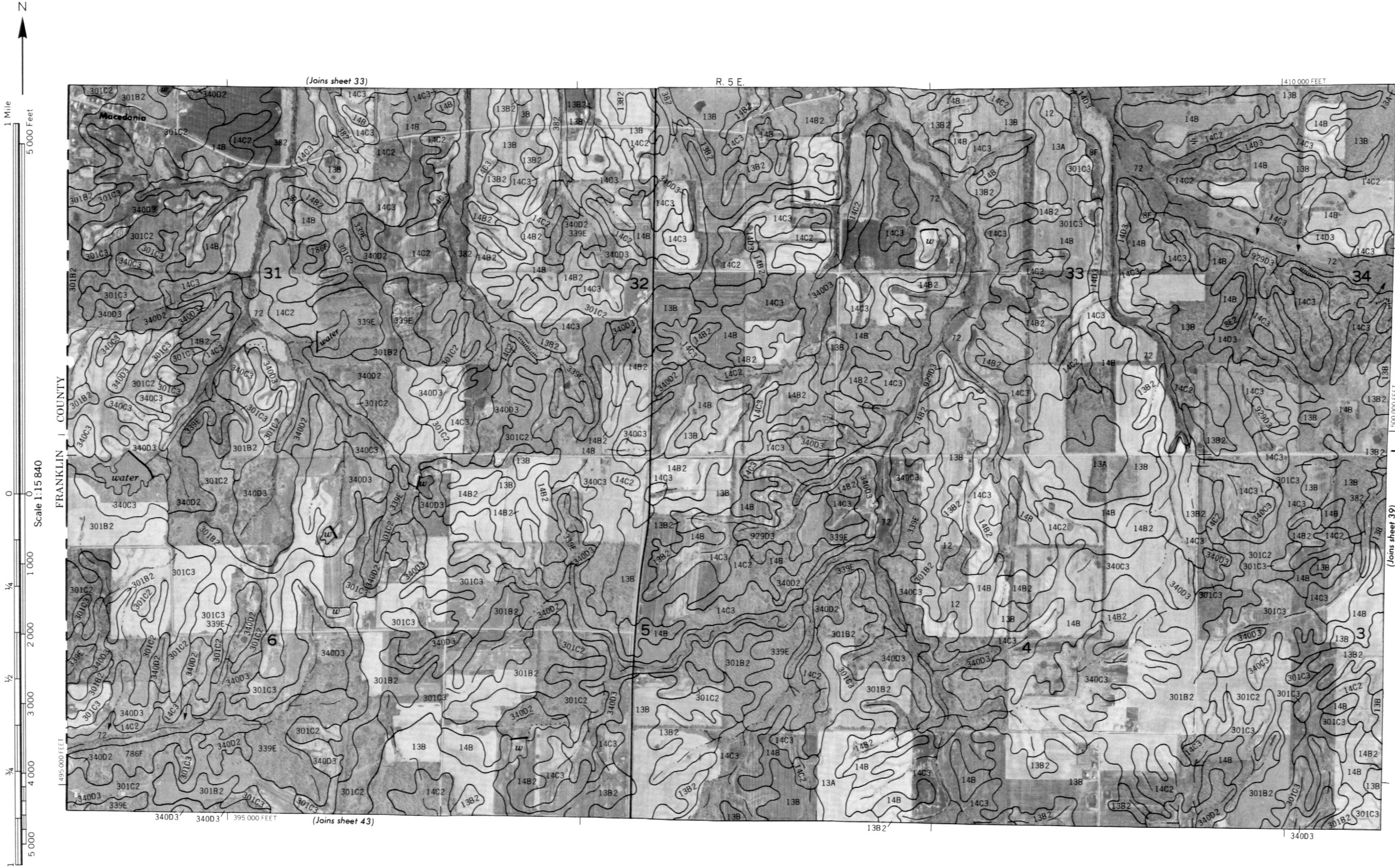
37

N



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

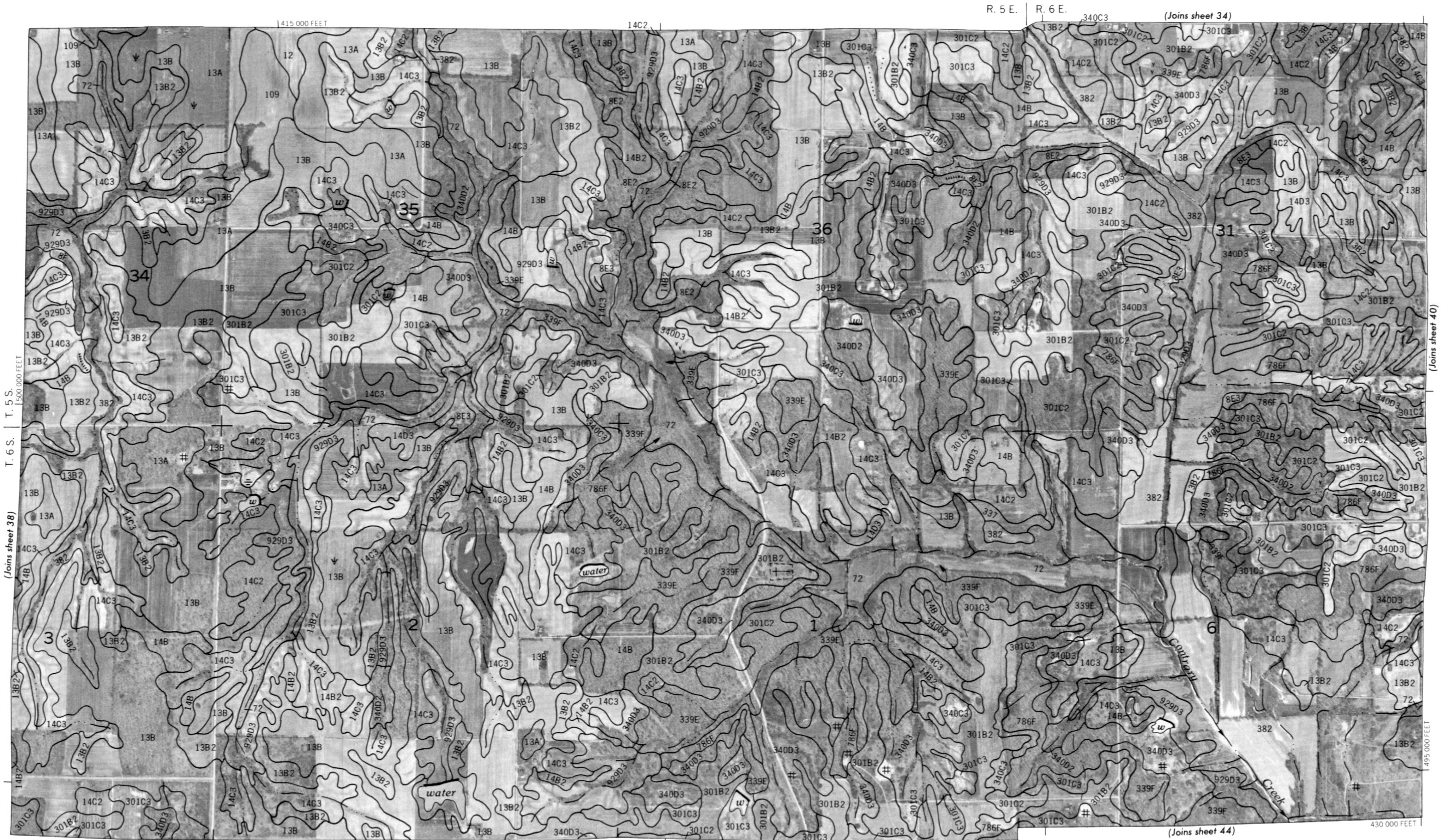
HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 38



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

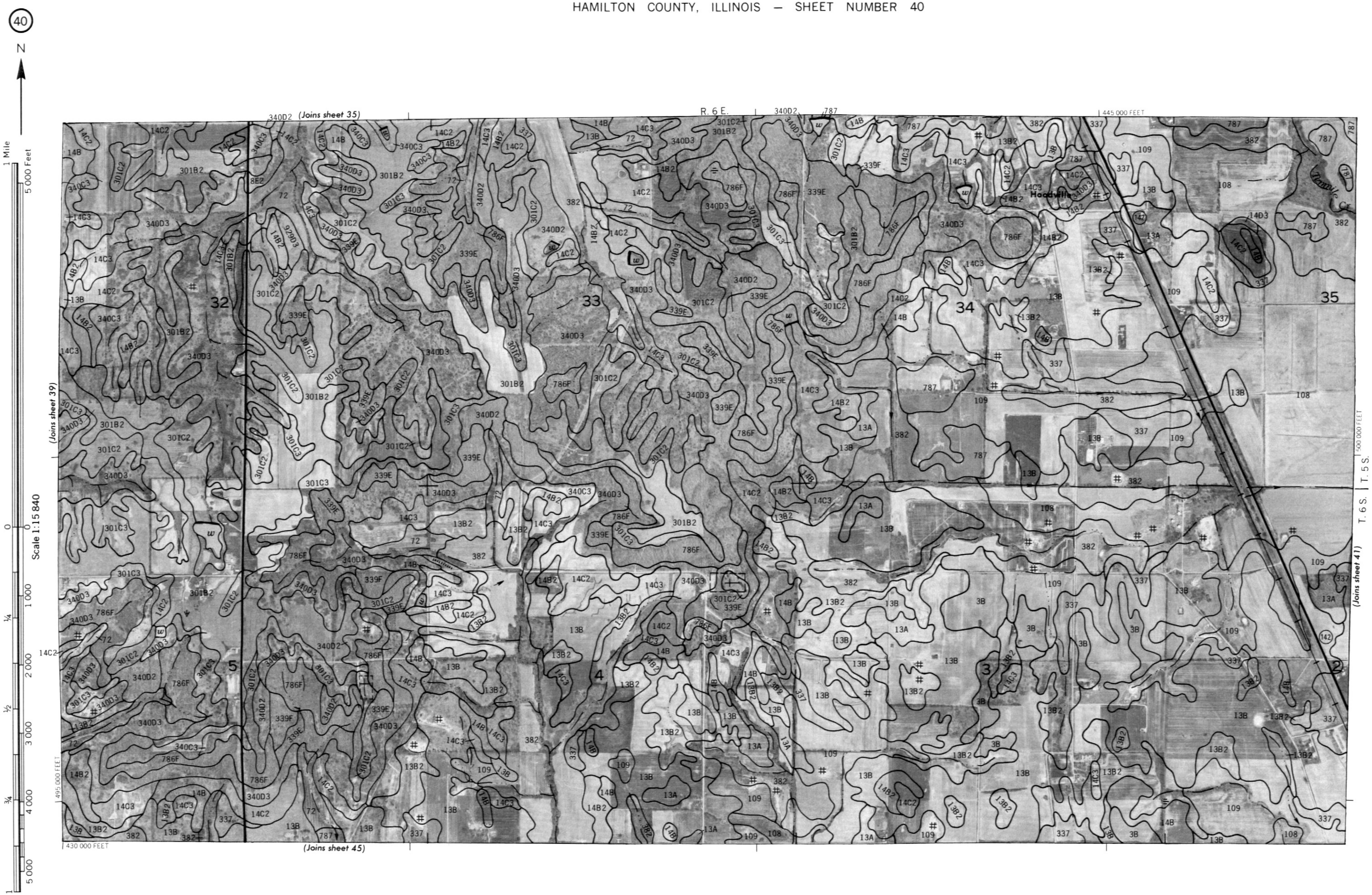
(39)

N

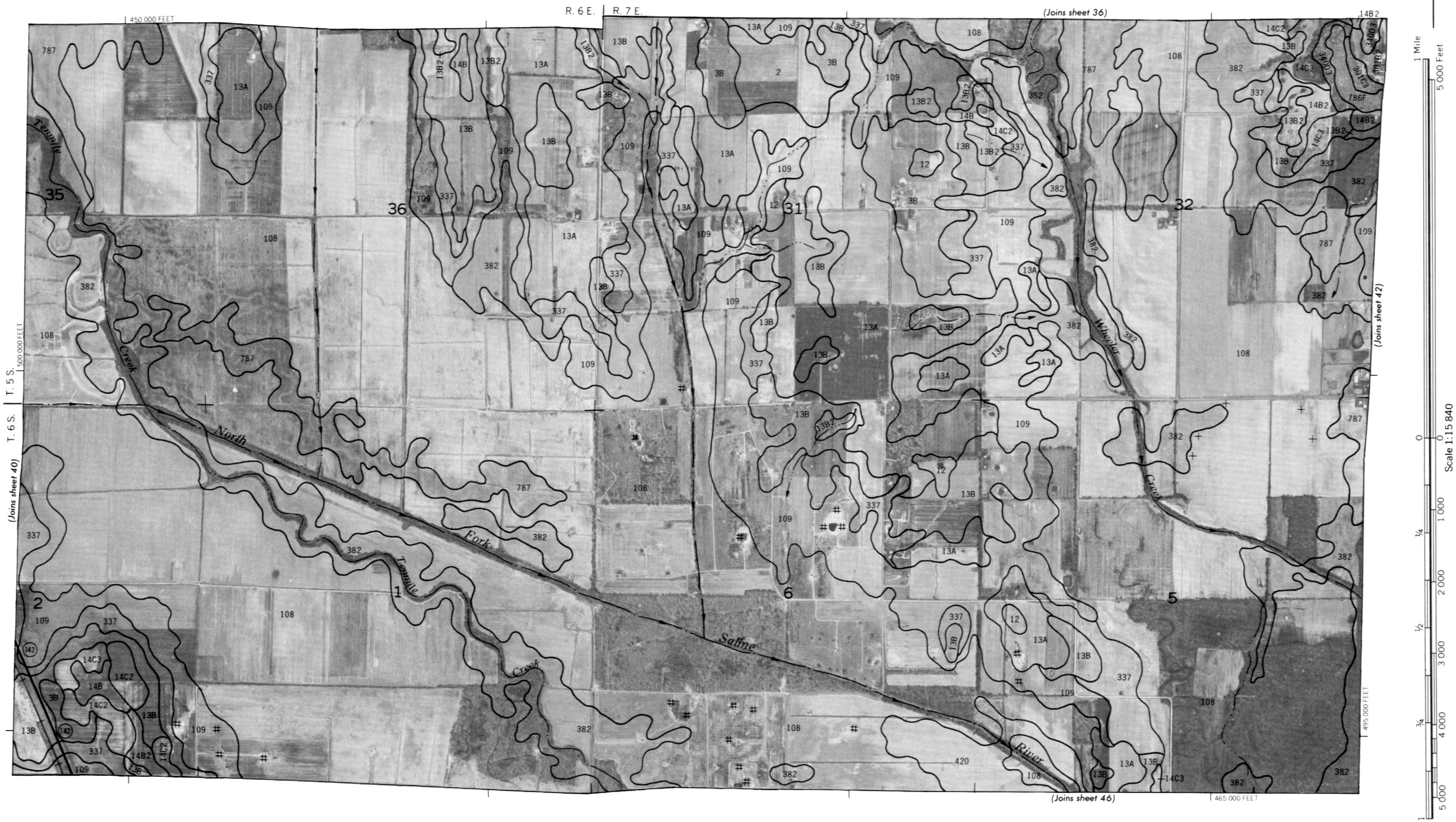


1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
1/4
1/2
3/4

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

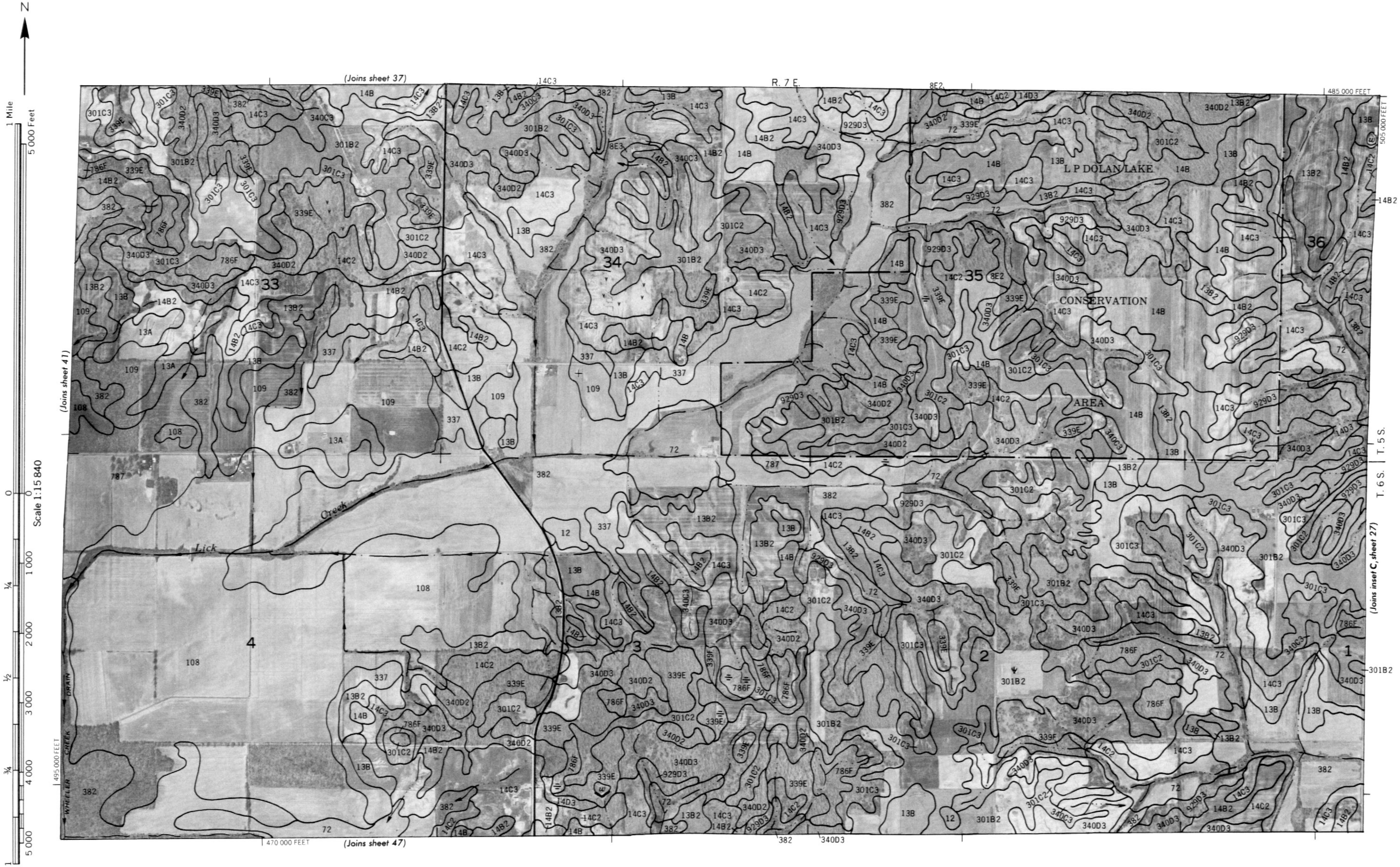


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



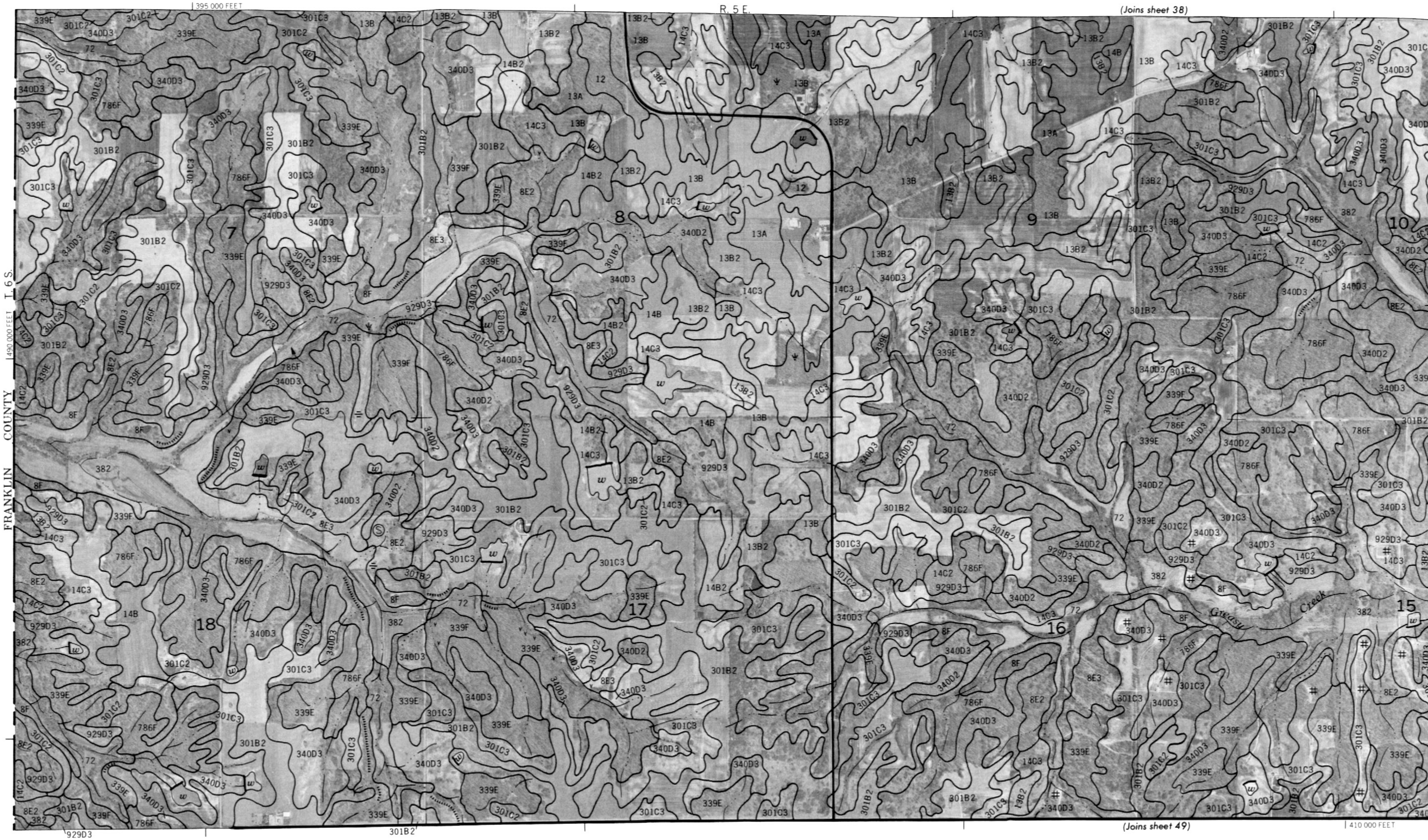
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 42



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

43



N

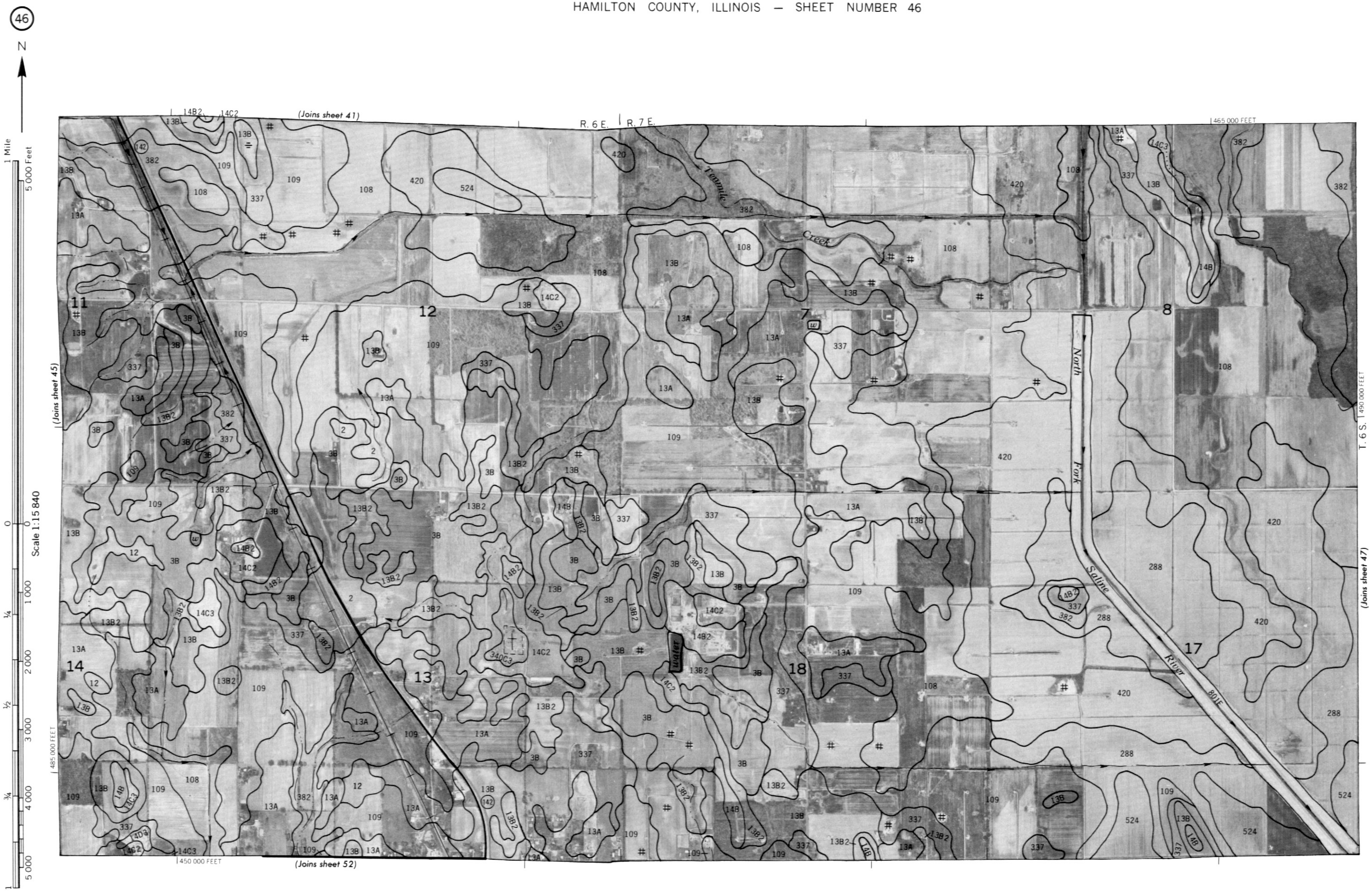
1 Mile
5 000 Feet
Scale 1:15 840

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

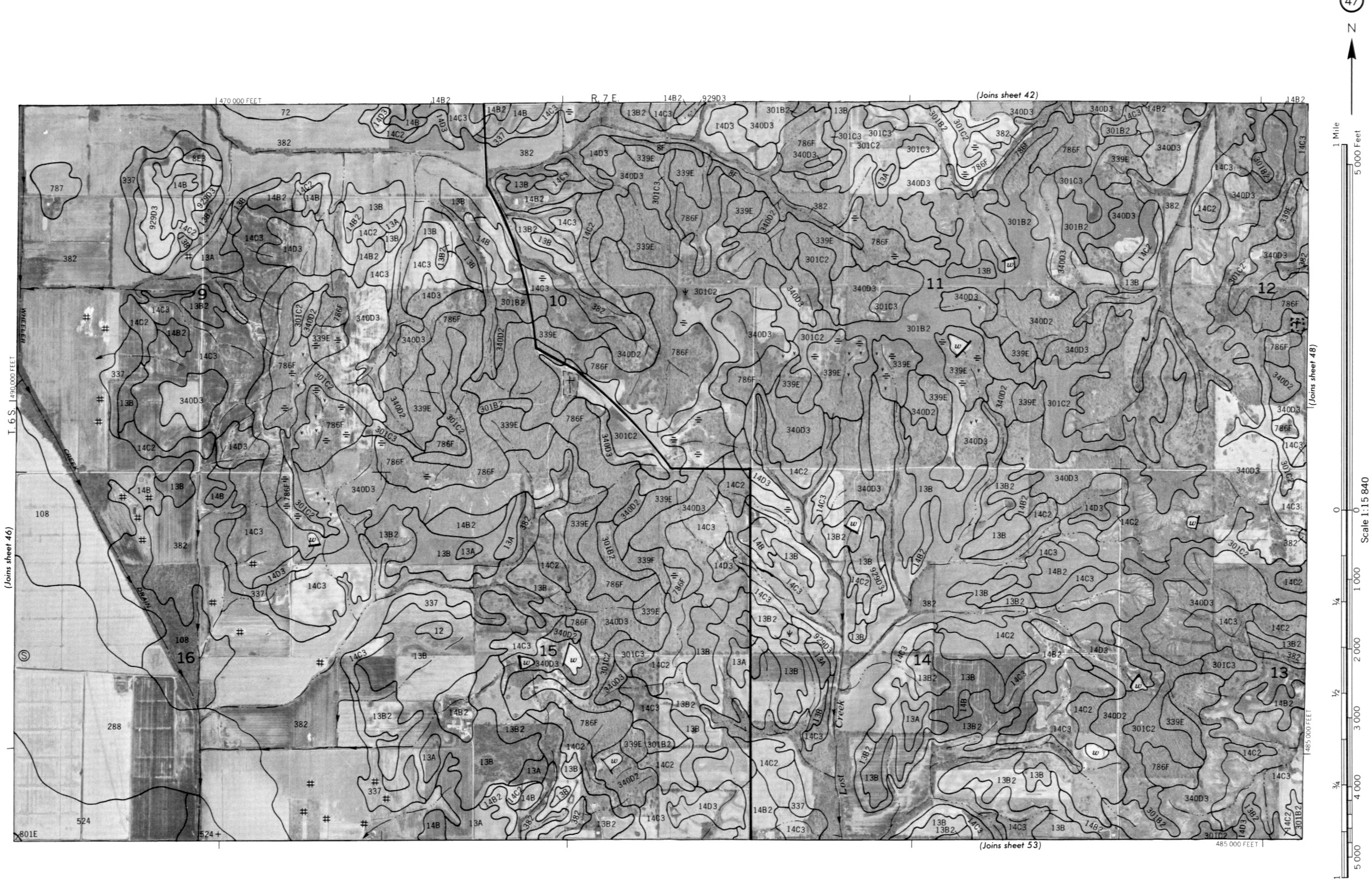
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 46

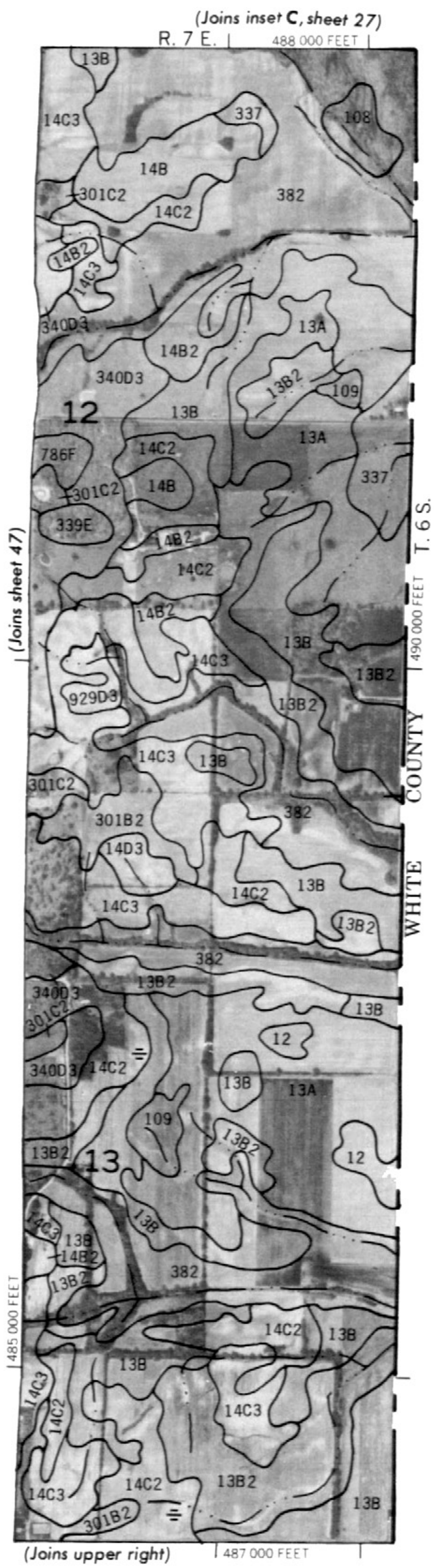


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



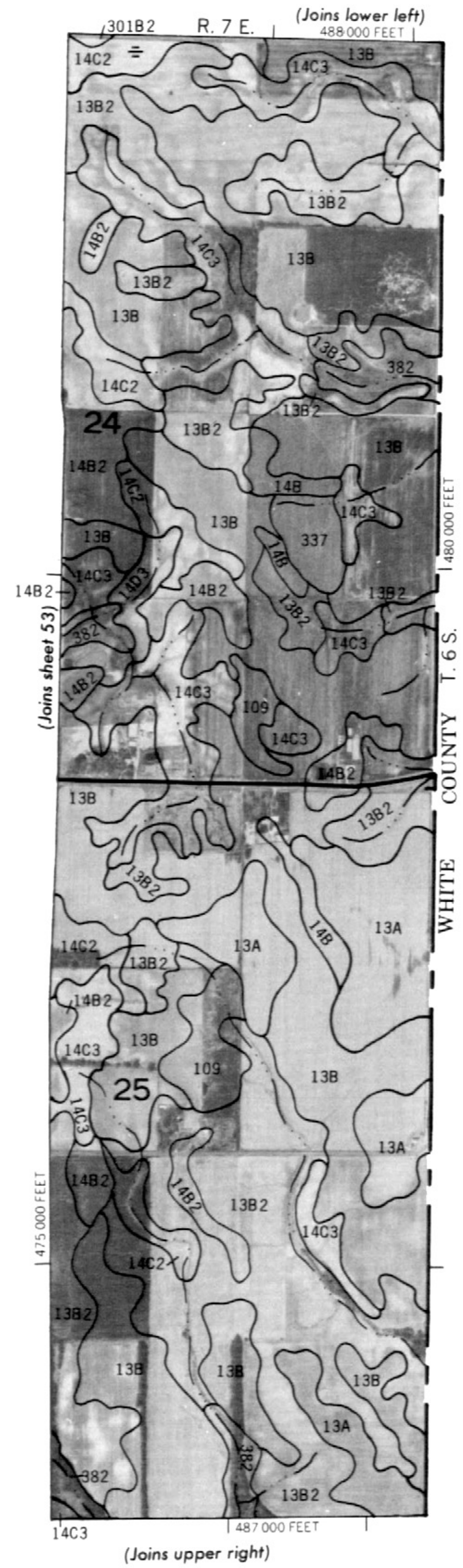
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

48



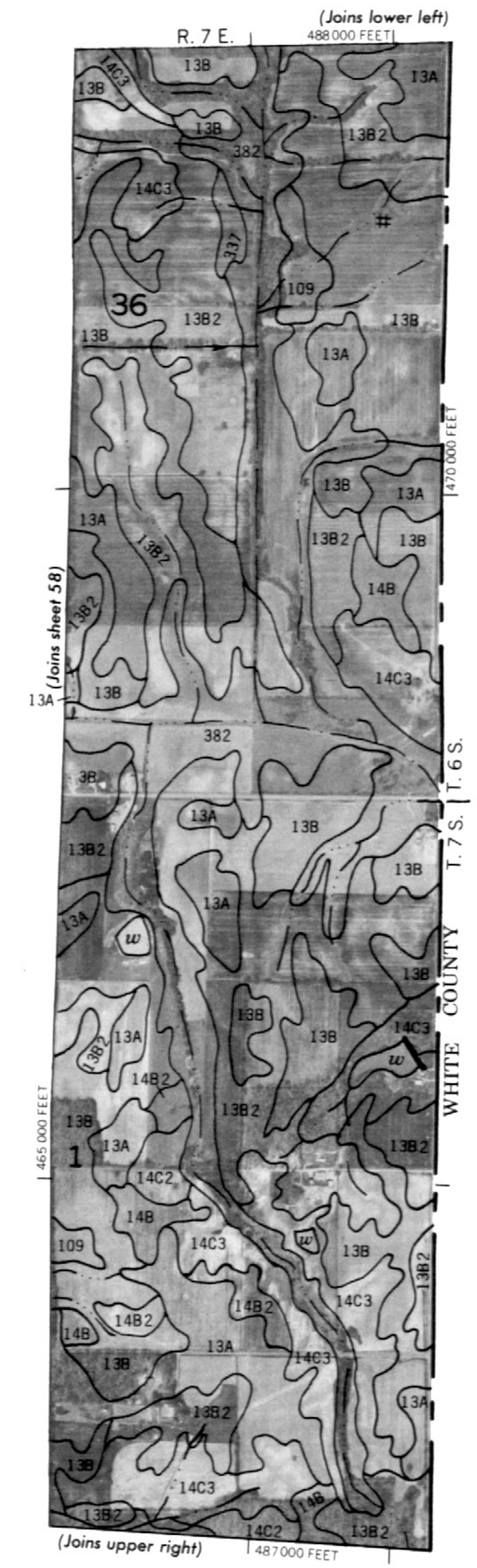
1000 AND 5000-FOOT GRID TICKS

INSET A



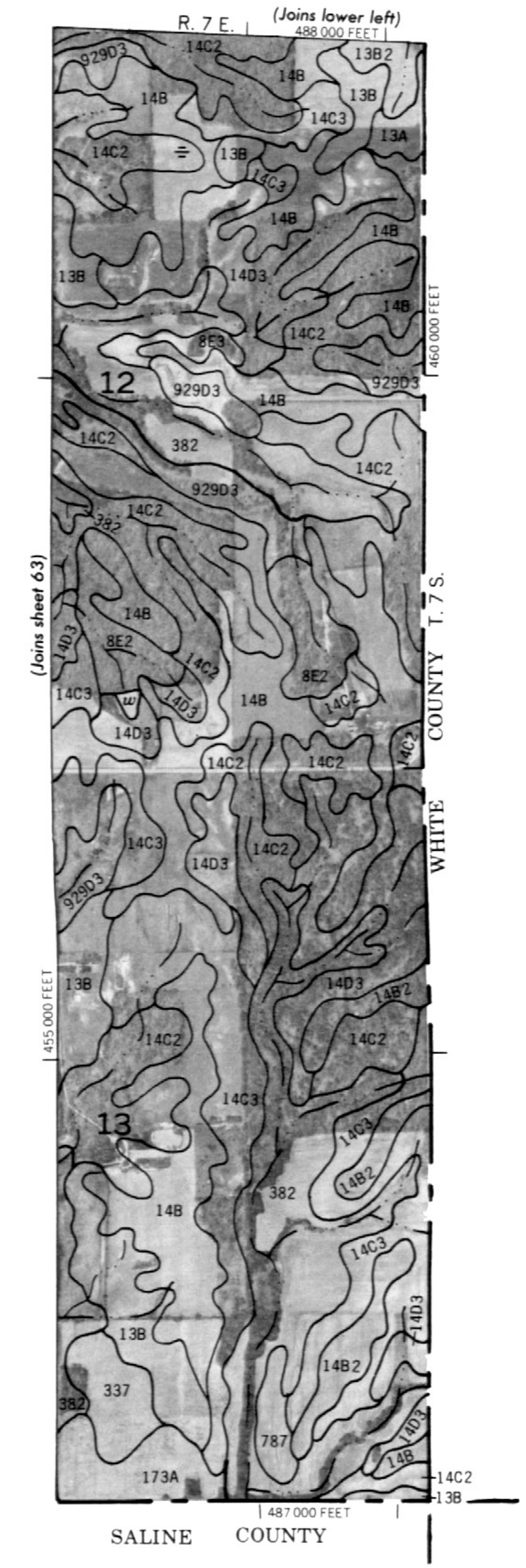
1000 AND 5000-FOOT GRID TICKS

INSET B



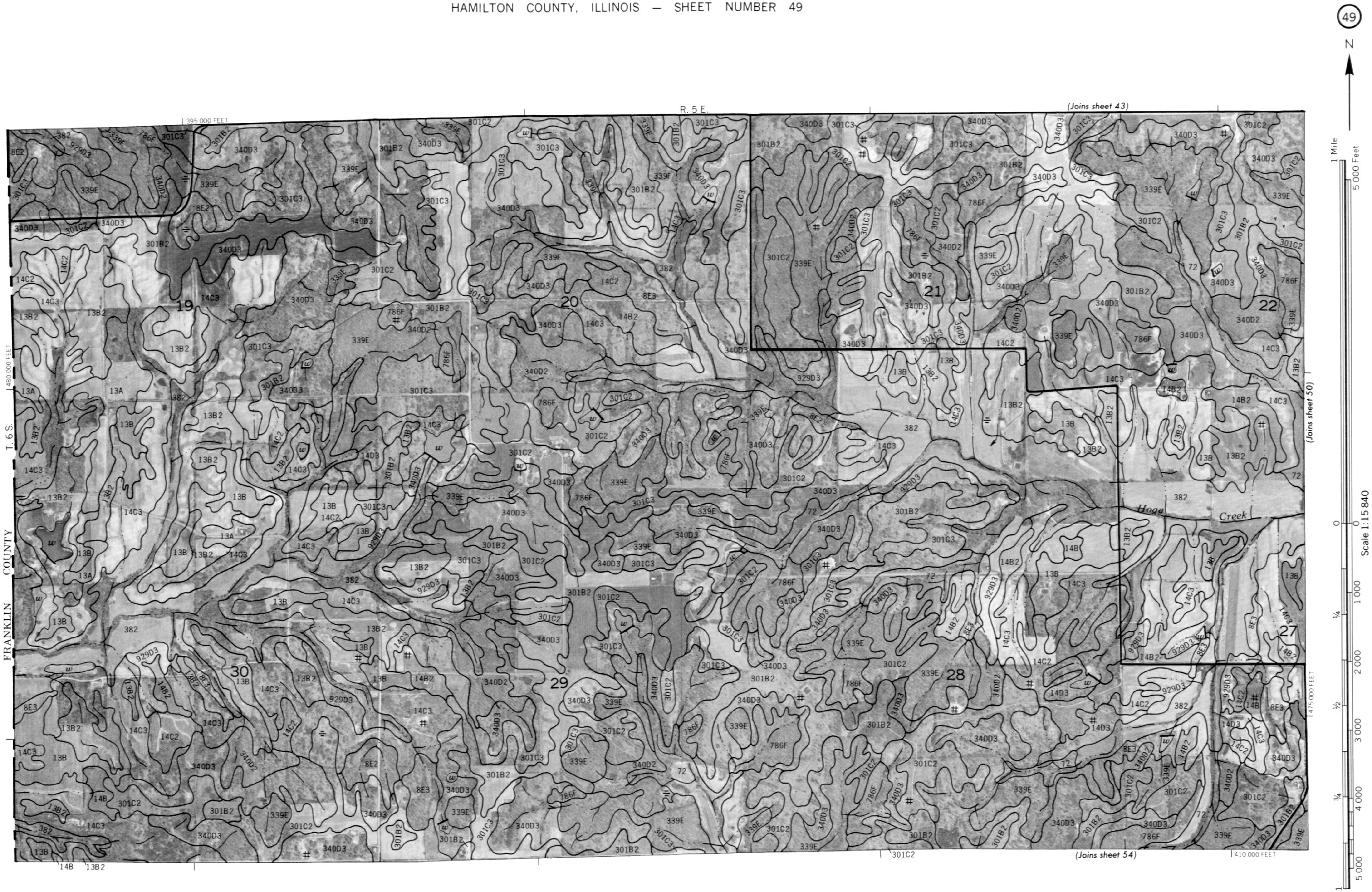
1000 AND 5000-FOOT GRID TICKS

INSET C

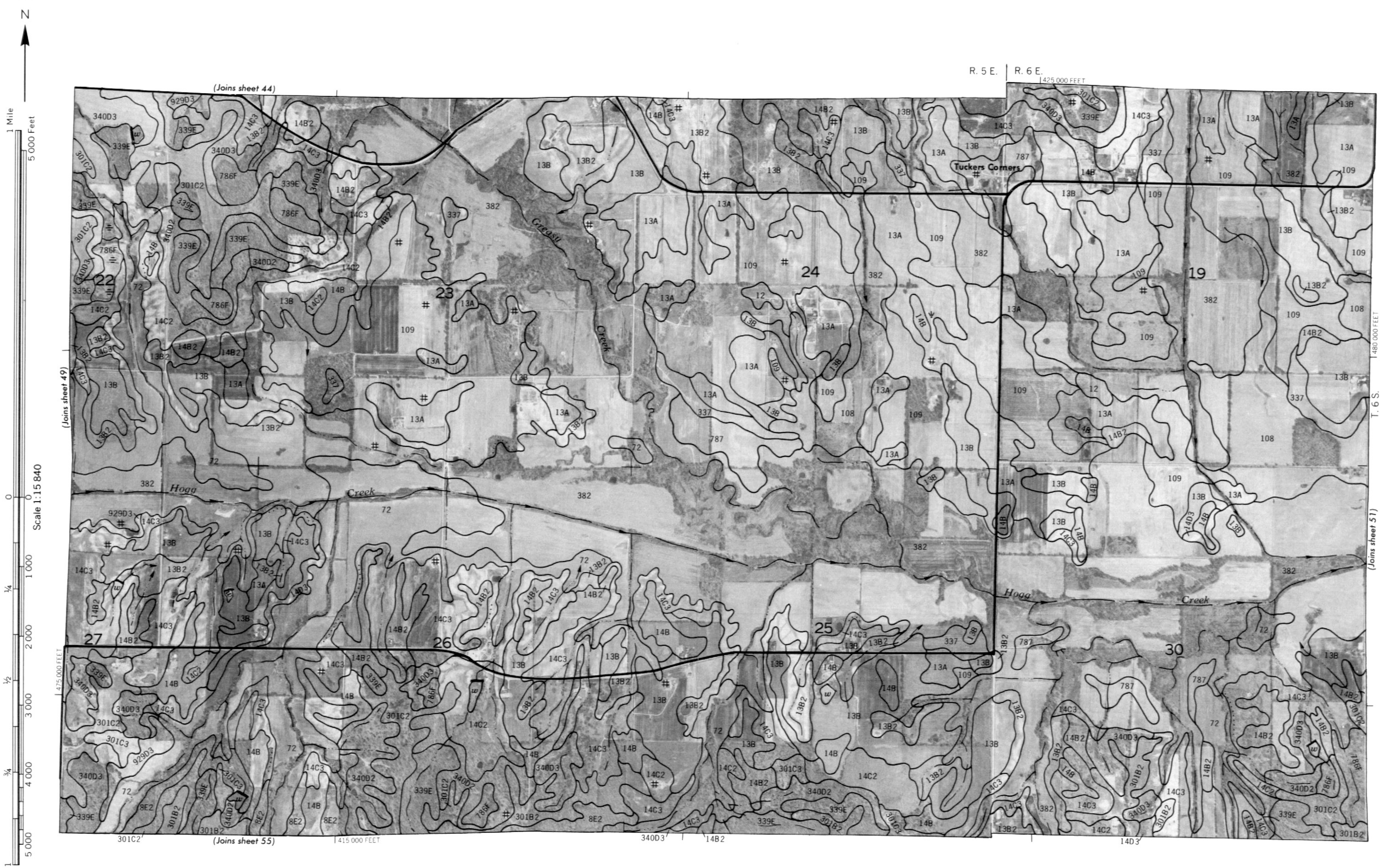


1000 AND 5000-FOOT GRID TICKS

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

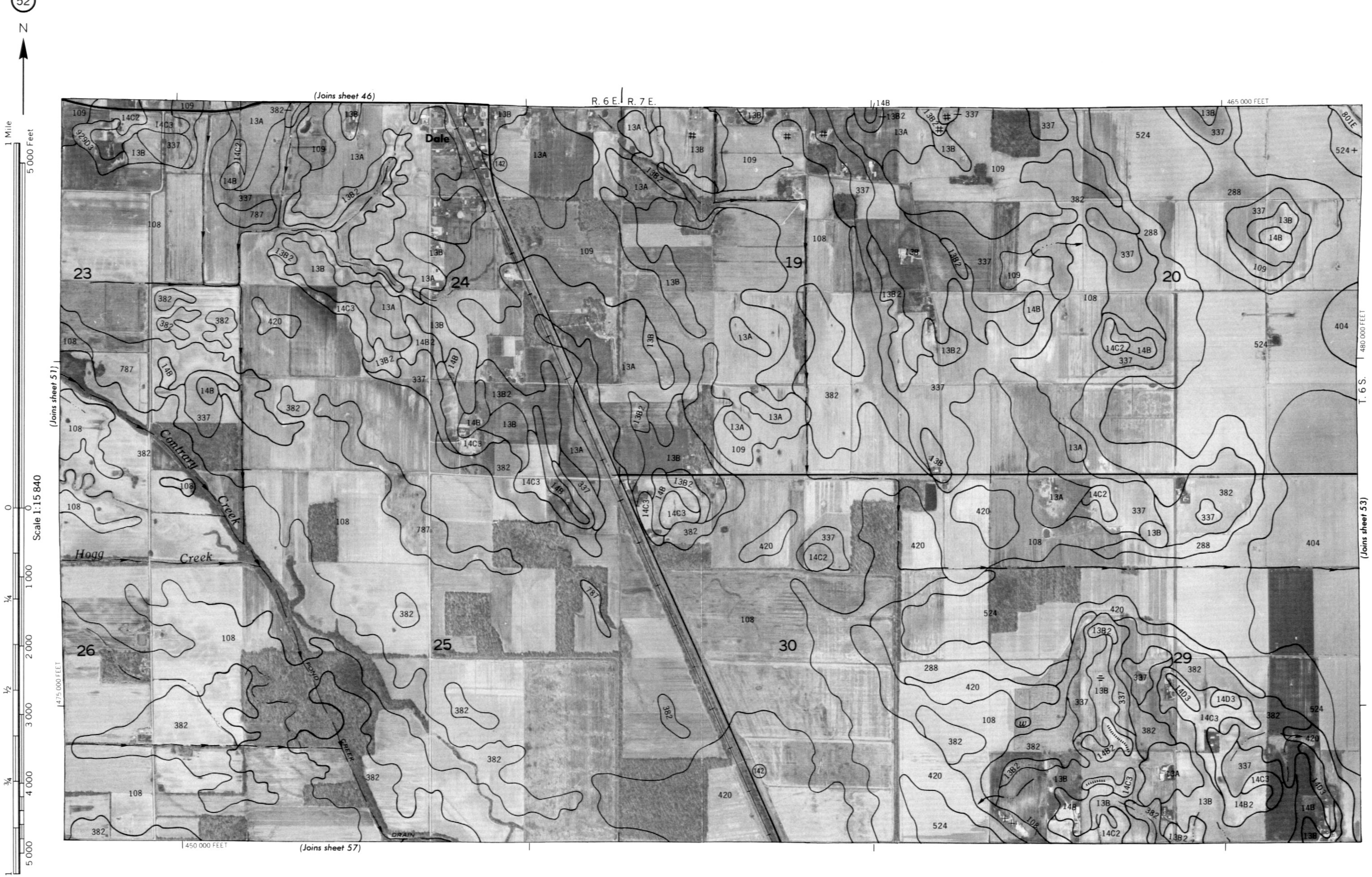


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



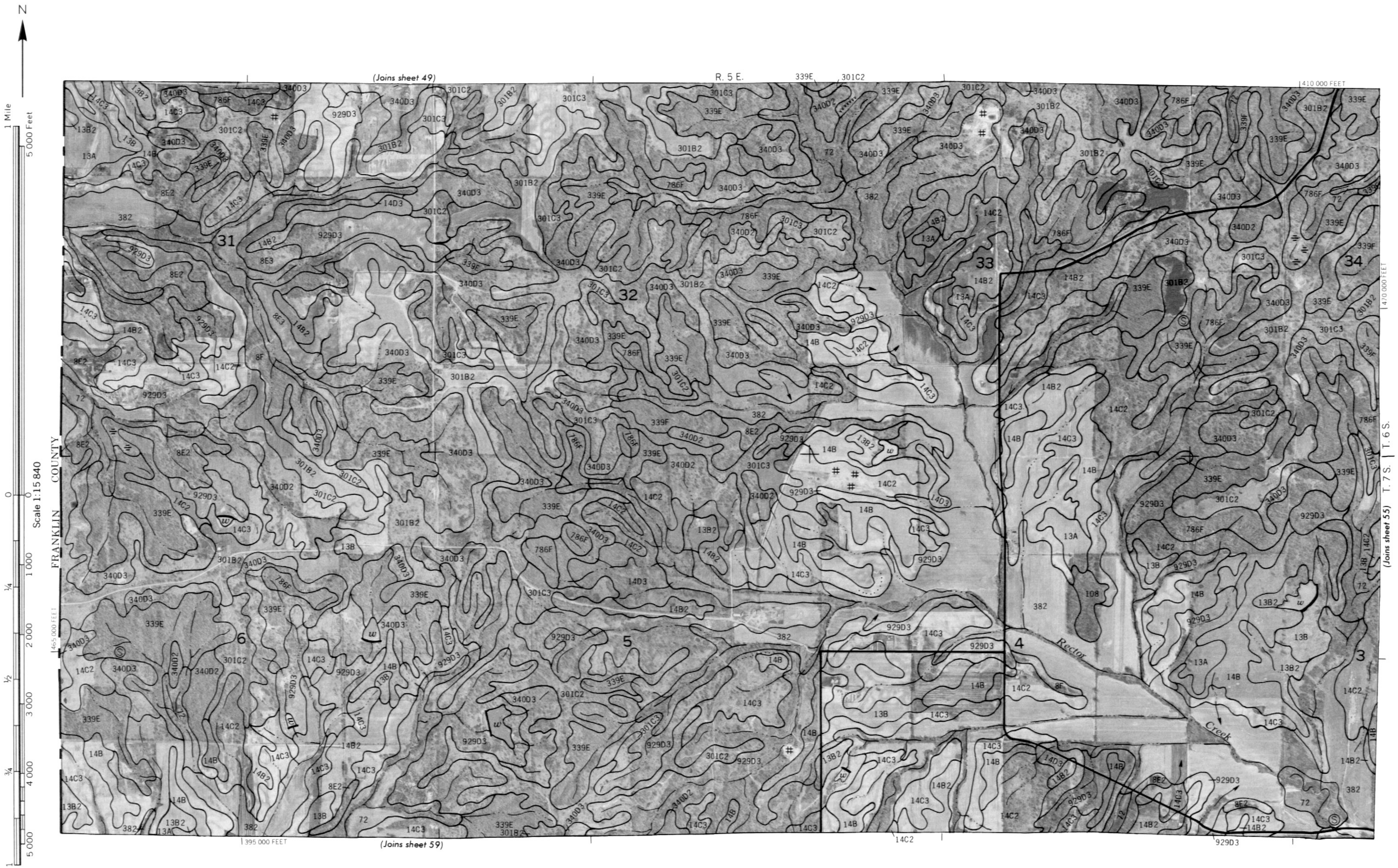
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



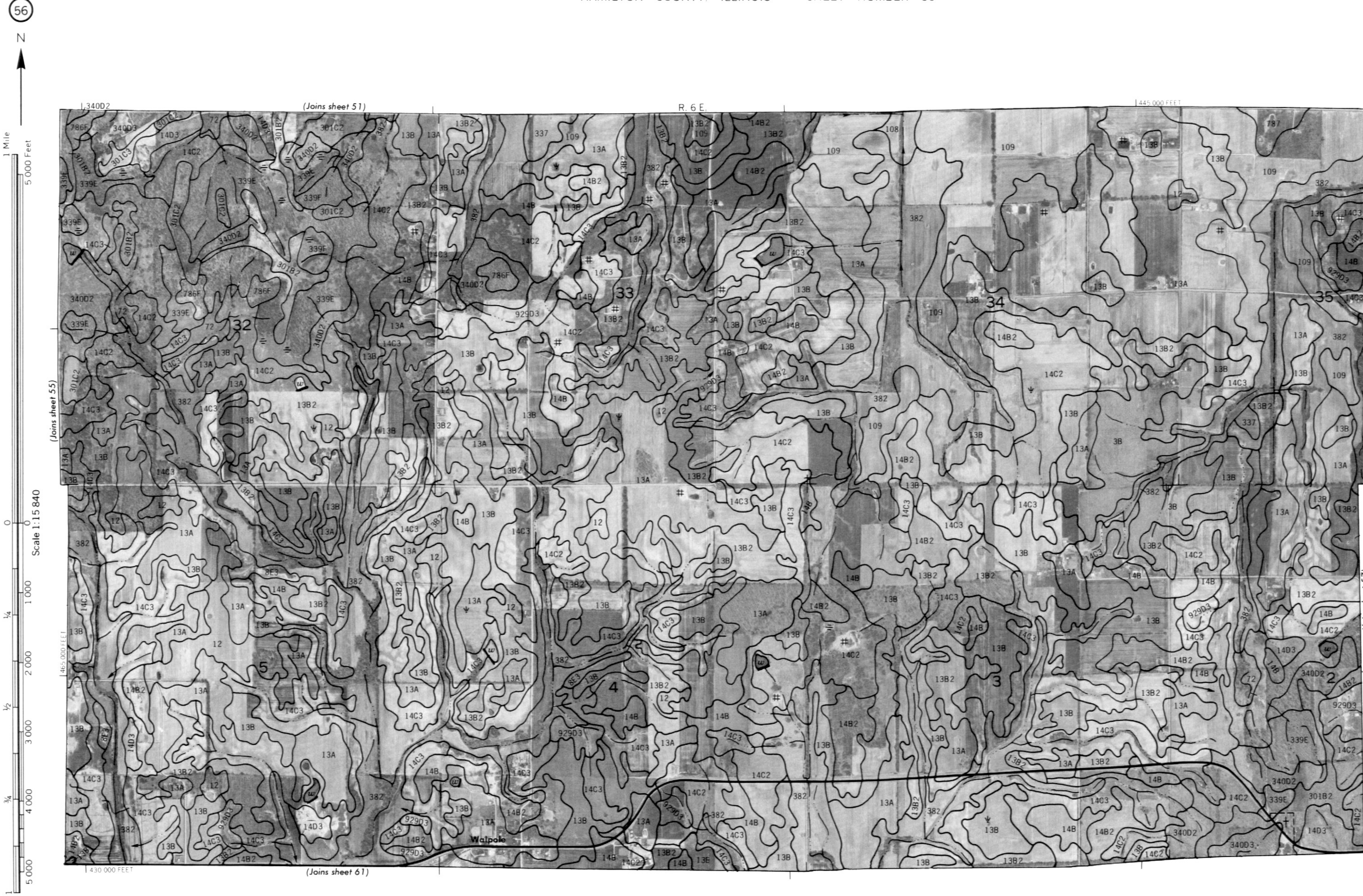
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

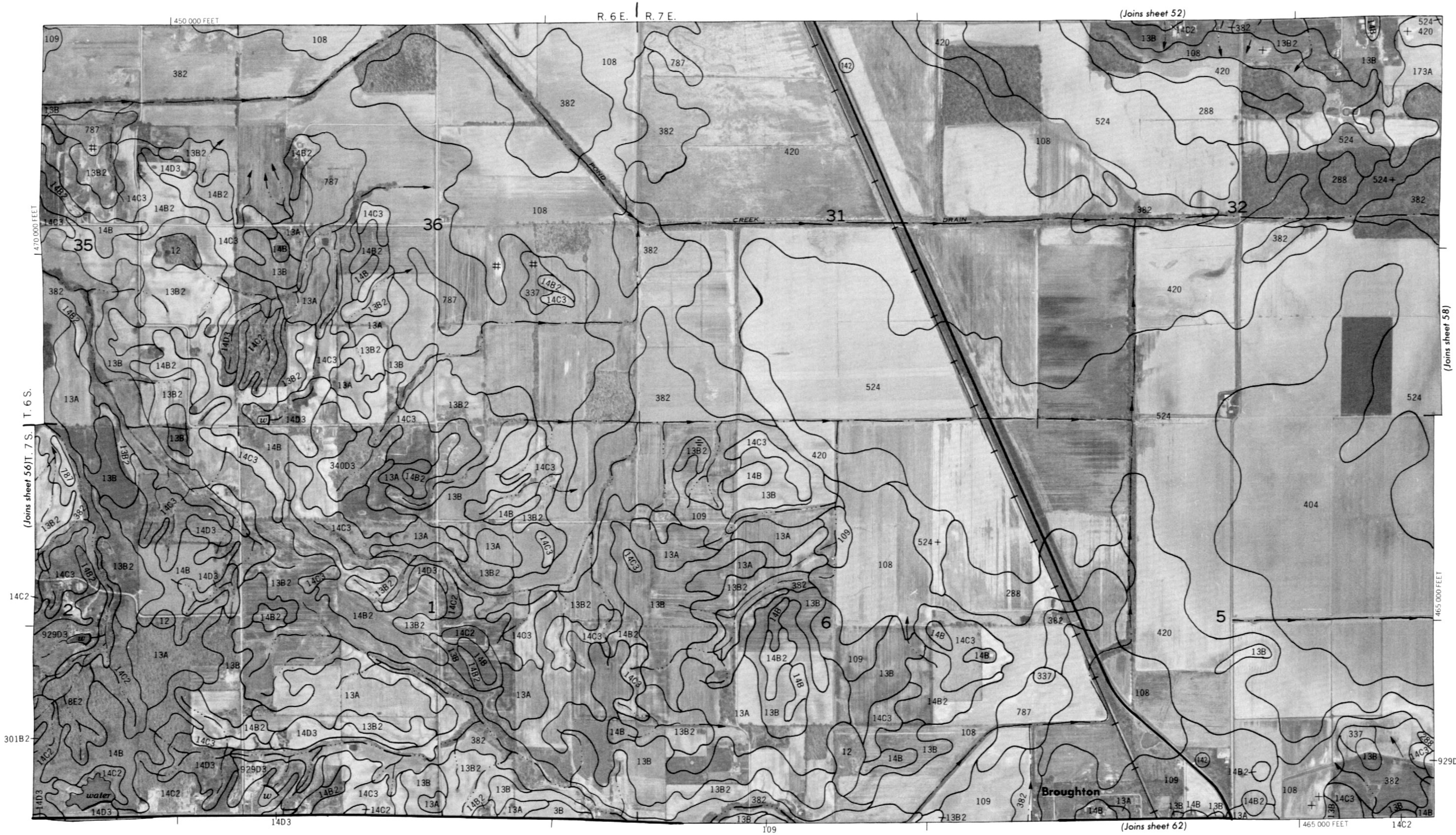


This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



N

Scale 1:15 840

1 Mile

5 000 Feet

0 1/4 1/2 3/4 1

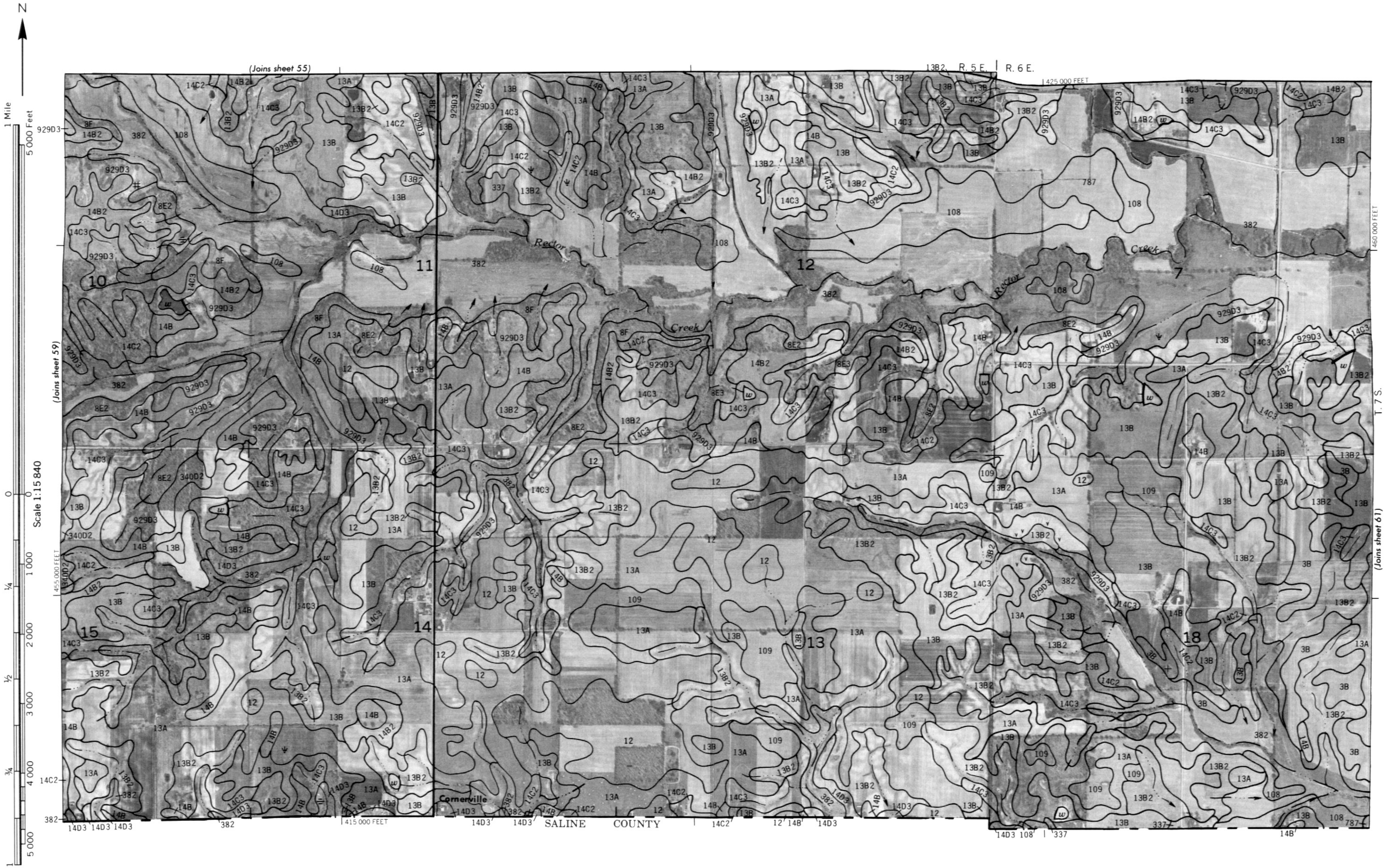
0 1 000 2 000 3 000 4 000 5 000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

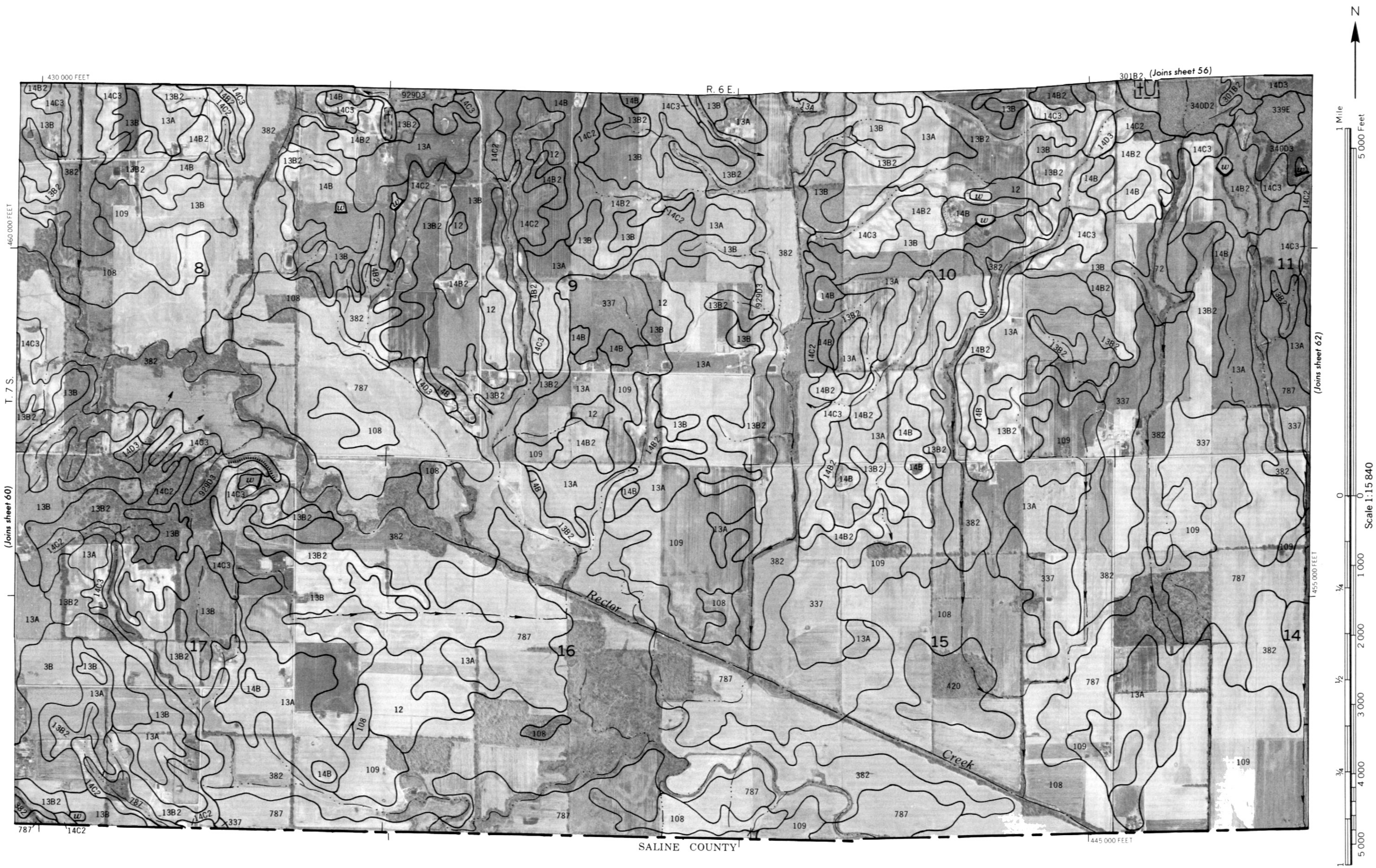
HAMILTON COUNTY, ILLINOIS — SHEET NUMBER 58

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

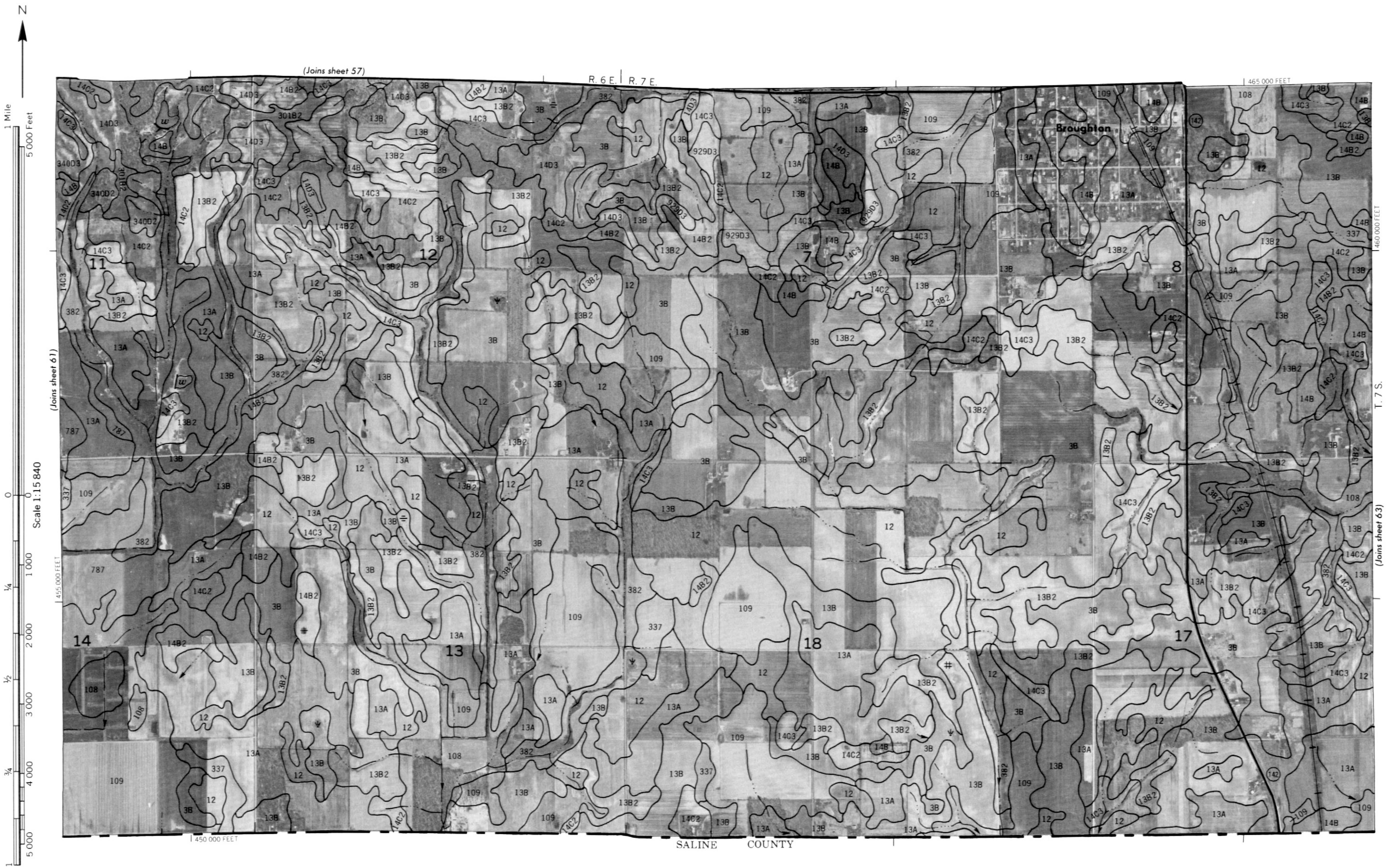
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned



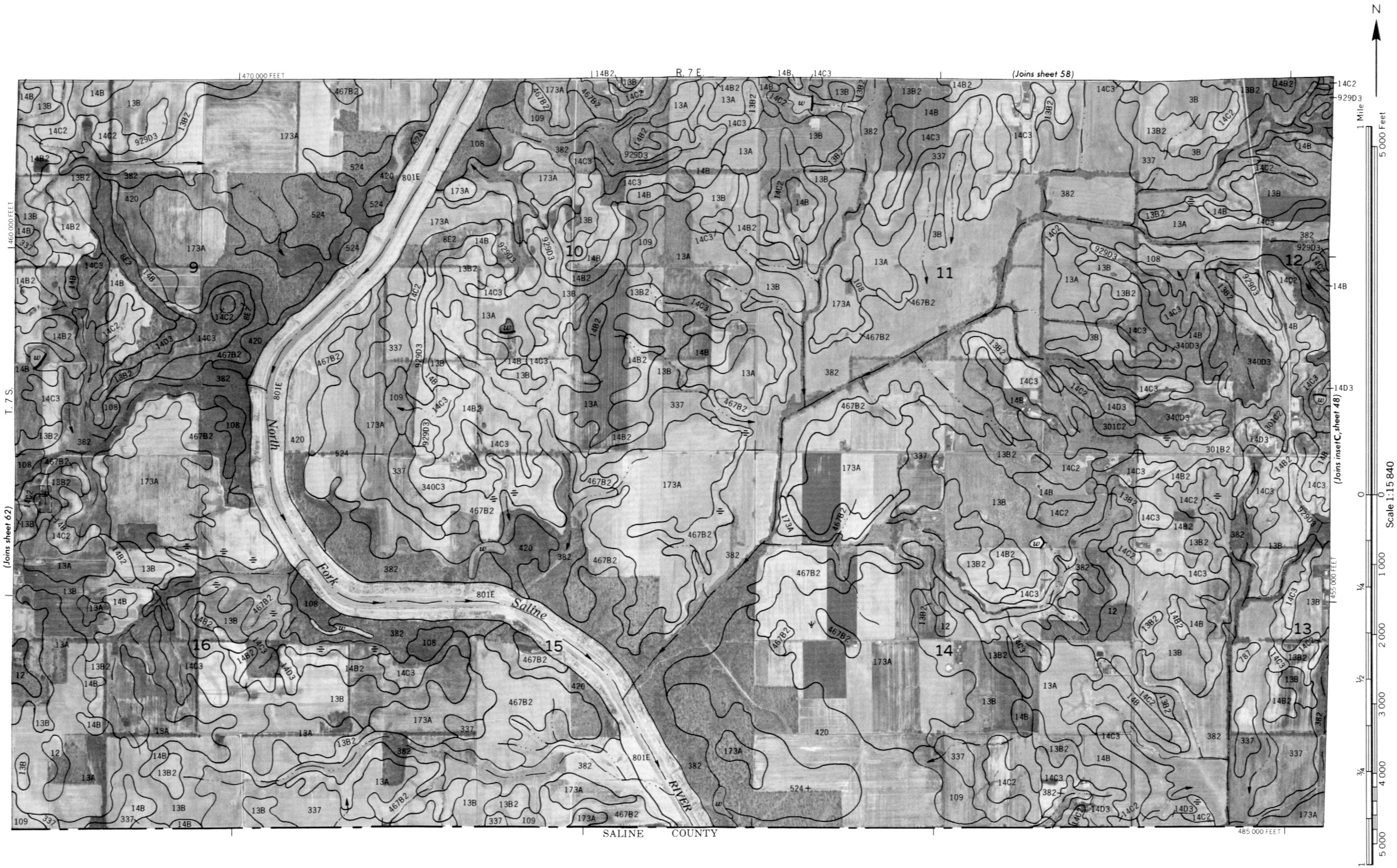
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.